



See the possibilities

User Manual

AM-800CL

AB-800CL

*8M Digital Progressive Scan
Monochrome and color Camera*

Document Version: ver.1.0
AMAB-800CL_Ver.1.0_March 2011

Notice

The material contained in this manual consists of information that is proprietary to JAI Ltd., Japan and may only be used by the purchasers of the product. JAI Ltd., Japan makes no warranty for the use of its product and assumes no responsibility for any errors which may appear or for damages resulting from the use of the information contained herein. JAI Ltd., Japan reserves the right to make changes without notice.

Company and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.

Warranty

For information about the warranty, please contact your factory representative.

Certifications

CE compliance

As defined by the Directive 2004/108/EC of the European Parliament and of the Council, EMC (Electromagnetic compatibility), JAI Ltd., Japan declares that AM-800CL-C, AM-800CL-F, AB-800CL-C and AB-800CL-F comply with the following provisions applying to its standards.

EN 61000-6-3 (Generic emission standard part 1)

EN 61000-6-2 (Generic immunity standard part 1)

FCC

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:


- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into a outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Warning

Changes or modifications to this unit not expressly approved by the party responsible for FCC compliance could void the user's authority to operate the equipment.

Supplement

The following statement is related to the regulation on “ Measures for the Administration of the control of Pollution by Electronic Information Products ” , known as “ China RoHS ” . The table shows contained Hazardous Substances in this camera.

 mark shows that the environment-friendly use period of contained Hazardous Substances is 15 years.

重要注意事项

有毒，有害物质或元素名称及含量表

根据中华人民共和国信息产业部『电子信息产品污染控制管理办法』，本产品《有毒，有害物质或元素名称及含量表》如下。


部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PPB)	多溴二苯醚 (PBDE)
螺丝固定座	×	○	○	○	○	○
连接插头	×	○	○	○	○	○
电路板	×	○	○	○	○	○
.....
<p>○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006规定的限量要求以下。 ×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006规定的限量要求。 (企业可在此处、根据实际情况对上表中打“×”的技术原因进行进一步说明。)</p>						



环保使用期限
电子信息产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外泄或突变、电子信息产品用户使用该电子信息产品不会对环境造成严重污染或对基人身、财产造成严重损害的期限。
数字「15」为期限15年。

Supplement

The following statement is related to the regulation on “ Measures for the Administration of the control of Pollution by Electronic Information Products ” , known as “ China RoHS ” . The table shows contained Hazardous Substances in this camera.

 mark shows that the environment-friendly use period of contained Hazardous Substances is 15 years.

重要注意事项

有毒，有害物质或元素名称及含量表

根据中华人民共和国信息产业部『电子信息产品污染控制管理办法』，本产品《有毒，有害物质或元素名称及含量表》如下。

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PPB)	多溴二苯醚 (PBDE)
螺丝固定座	×	○	○	○	○	○
光学滤色镜	×	○	×	○	○	○
连接插头	×	○	○	○	○	○
电路板	×	○	○	○	○	○
.....
<p>○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006规定的限量要求以下。 ×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006规定的限量要求。 (企业可在此处、根据实际情况对上表中打“×”的技术原因进行进一步说明。)</p>						



环保使用期限
电子信息产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外泄或突变、电子信息产品用户使用该电子信息产品不会对环境造成严重污染或对基人身、财产造成严重损害的期限。
数字「15」为期限15年。

- Contents -

Before using AM-800CL and AB-800CL	- 6 -
1. General	- 7 -
2. Camera nomenclature	- 8 -
3. Main features	- 8 -
4. Locations and functions	- 9 -
4.1 Locations and functions (C-mount)	- 9 -
4.2 Locations and functions (F-mount)	- 10 -
4.3 Rear panel	- 11 -
5. Input and output	- 12 -
5.1 Connectors and pin assignment	- 12 -
5.1.1 Hirose 12Pin connector	- 12 -
5.1.1.1 Figure	- 12 -
5.1.1.2 Pin assignment	- 12 -
5.1.2 Camera Link connector	- 12 -
5.1.2.1 Figure	- 12 -
5.1.2.2 Pin assignment	- 13 -
5.1.3 DIP switch SW500	- 13 -
5.2 Camera Link interface	- 14 -
5.3 Interface circuits	- 14 -
5.3.1 Iris video output	- 14 -
5.3.2 Trigger input	- 15 -
5.3.3 XEEN output	- 15 -
5.4 Output	- 16 -
5.4.1 Digital output	- 16 -
5.4.1.1 Bit allocation	- 16 -
5.4.1.2 Camera link output	- 16 -
5.4.2 Partial scan readout (AOI) (Commands: STL, ETL)	- 17 -
5.4.2.1 Frame rate calculation if AOI is set	- 17 -
5.4.2.2 If the bit allocation is set to 8,10 or 12bit and the binning is OFF or 2x1	- 18 -
5.4.2.3 If the bit allocation is set to 8,10 or 12bit and the binning is 1x2 or 2x2	- 18 -
5.4.2.4 If the bit allocation is set to RGB	- 19 -
5.4.2.5 Setting example 1	- 19 -
5.4.2.6 Setting example 2	- 20 -
5.4.2.7 Setting example 3	- 20 -
5.4.3 Binning (Command : BNC) (Only for AM-800CL)	- 21 -
5.4.4 Bayer output pattern	- 21 -
6. Sensor layout and timing	- 22 -
6.1 Sensor layout	- 22 -
6.2. Vertical timing (8bit, 10 bit or 12bit for Bit allocation)	- 22 -
6.2.1 If the binning control is BNC=0(OFF) or BNC=2(2x1)	- 22 -
6.2.1.1 AOI default setting (Offset=0, Height=2472)	- 22 -
6.2.1.2 AOI setting	- 23 -
6.2.2 If the binning control is BNC=1(1x2) or BNC=3(2x2)	- 23 -
6.2.2.1 AOI initial setting (Offset=0, Height=2472)	- 23 -
6.2.2.2 AOI setting	- 24 -
6.3. Vertical timing (Bit allocation = RGB)	- 25 -
6.3.1 AOI initial setting	- 25 -
6.3.2 AOI setting	- 25 -
6.4. Horizontal timing	- 26 -
6.4.1 If the binning control is 0=OFF or 2=2x1	- 26 -

6.4.2	If the binning control is 1=1x2 or 3=2x2	- 26 -
6.4.3	DVAL output if the Binning control is set to 2=2x1or 3=2x2	- 26 -
6.4.4	LVAL-LOW level period	- 27 -
7.	Operating modes.....	- 28 -
7.1.	Acquisition control (Change the frame rate)	- 28 -
7.2.	Exposure setting.....	- 28 -
7.2.1	Mode	- 29 -
7.2.2	Exposure time setting (Command: PE)	- 29 -
7.2.3	Exposure sequence (Commands EXSQ,PES(N), PER(N), EXSR, EXSEP, PE1 ~PE16)	- 29 -
7.3.	Trigger Control.....	- 29 -
7.3.1	Selection of the trigger input(Command: TI)	- 29 -
7.3.2	Trigger activation(Command: TA)	- 29 -
7.3.3	Trigger Overlap (Command: TO)	- 30 -
7.3.4	Trigger Dump (Command: TD).....	- 30 -
7.4.	Auto shutter control (Commands: ASC,ASCS,ASCEA,ASCEI).....	- 30 -
7.5.	Normal continuous operation.....	- 31 -
7.6.	Timed mode (so-called EPS operation)	- 32 -
7.6.1	If the overlap setting is "OFF"	- 32 -
7.6.2	If the overlap setting is "Readout".....	- 33 -
7.7.	Trigger width mode (so-called PWC)	- 34 -
7.7.1	If the overlap setting is "Non Overlap".....	- 34 -
7.7.2	If the overlap setting is "Readout"	- 35 -
7.8.	Edge-dump mode (so-called RCT)	- 36 -
7.9.	PIV(Particle Image Velocimetry)	- 37 -
7.10.	Operation and function matrix	- 37 -
8.	Other functions	- 38 -
8.1	Black level control (Command : BL).....	- 38 -
8.2	Gain control (Relative commands GA,GJUT1,2,3)	- 38 -
8.3	Tap control (Relative commands AWA,ABA,GJUT1, GJUT2,GJUT3).....	- 38 -
8.4.	Exposure auto (Related Commands : ASC=1(ON),ASCS,ASCEA,ASCEI).....	- 39 -
8.5.	Auto white balance (Related commands:AWB, PGS, PGR, PGGR, PGGB, PGB).....	- 39 -
8.6.	Blemish compensation.....	- 40 -
8.7.	LUT (Relative commands LUTC,LUTR,LUYG, LUTB).....	- 40 -
8.8.	Gamma (Command: GAMS)	- 41 -
8.9.	Flat Field Correction (FFC) (Command: SDR)	- 41 -
8.10.	Bayer color interpolation (Command : BCIC) (Only for AB-800CL).....	- 42 -
8.11.	Test pattern (Command: TPN)	- 42 -
8.12.	Temperature sensor (Command : TMPO)	- 43 -
9.	Configuring the camera.....	- 44 -
9.1	RS-232C control.....	- 44 -
9.2	Communication setting.....	- 44 -
9.3.	Save and load functions	- 45 -
9.4	Command list	- 45 -
10.	Camera control tool	- 53 -
10.1.	Control tool windows.....	- 53 -
10.2.	Camera Control Tool interface.....	- 53 -
10.2.1	About Window.....	- 53 -
10.2.2	Communication Window	- 54 -
10.2.3	Camera Control Window	- 56 -
11.	External appearance and dimensions.....	- 58 -
12.	Specifications	- 60 -
12.1	Spectral response	- 60 -

12.2 Specifications table.....	- 61 -
Appendix.....	- 63 -
1. Precautions	- 63 -
2. Typical Sensor Characteristics.....	- 63 -
3. Caution when mounting a lens on the camera.....	- 63 -
4. Caution when mounting the camera	- 64 -
5. Exportation	- 64 -
6. References.....	- 64 -
Manual change history	- 65 -
User's Record	- 66 -

Before using AM-800CL and AB-800CL

The CCD sensor used in the AM-800CL and AB-800CL operates with four (4) taps and a 40MHz pixel clock. However, the video output through the Camera Link® interface is 2 taps for monochrome and Bayer color modes, and 1 tap for RGB color output.

Accordingly, the pixel clock at the Camera Link interface is 80MHz and users should make sure that the specifications and performance of connected frame grabber boards and PCs can support this clock speed. The maximum length of the Camera Link cable may also be impacted.

The AM-800CL and AB-800CL are high resolution and high frame rate cameras with 3296(h) x 2472(v) pixel resolution and a 17fps frame rate for monochrome and Bayer color.

Accordingly, the amount of data produced is very large. If the output is set at 10-bits or 12-bits per pixel, the total data stream is approx. 2.2 Gbit/sec. as a 16-bit process in the frame grabber board. A frame grabber board connected to the PCI-32bit bus has a bandwidth of 2.1 Gbits/sec and therefore, all frames may not be displayed.

In this case, it is recommended to use the PCI-64bit bus or to use a frame grabber board that can utilize the PCI Express Bus x 8.

JAI recommends using a PC with CPU better than i7.

It should be noted, even though you use the mentioned PC, you might not capture a full of 17fps image while you view full resolution images on the screen.

1. General

The AM-800CL is a 4/3 inch monochrome progressive scan CCD camera and the AB-800CL is the equivalent Bayer mosaic progressive scan CCD camera. Both have 8 million pixels resolution and 4 taps in the sensor. They provide 17 frames per second for continuous scanning with 3296 x 2472 full pixel resolution.

Both AM-800CL and AB-800CL are suitable for automated optical inspection applications, such as solid state device inspection or material surface inspection.

They incorporate various processing circuits such as LUT, FFC(Flat Field Compensation), blemish compensation and Bayer interpolation. The AM-800CL and AB-800CL work in continuous, single frame, and multi-frame modes for acquisition control together with timed, trigger width and trigger controlled exposure controls. Both cameras also have edge-dump and PIV modes.

The AM-800CL has H and V binning modes and both the AM-800CL and AB-800CL have an AOI (Area Of Interest) mode for achieving a faster frame rate.

The digital output is through a Camera Link[®] digital interface with 8-bits , 10-bits or 12-bits of pixel bit depth.

The latest version of this manual can be downloaded from: www.jai.com

The latest version of Camera Control Tool for the AM-800CL and AB-800CL can be downloaded from: www.jai.com

For camera revision history, please contact your local JAI distributor.

Special note:

In this manual, some new terminologies are used as compared to the terms used in previous JAI operation manuals.

Previous

EPS
PWC
RCT(Reset Continuous)
Partial scan
Shutter
Auto shutter

New

Timed
Trigger width
Edge-dump
AOI (Area Of Interest)
Exposure
Exposure Auto

2. Camera nomenclature

The standard camera composition consists of the camera main body and lens protection cap.

The camera is available in the following versions:

AM-800CL-C

AM-800CL-F

Where A stands for "Advanced" family, M stands for "Monochrome", 800 represents the resolution "8 million pixel" , CL stands for "Camera Link" interface and C for C-mount lens or F for E-mount lens

AB-800CL-C

AB-800CL-F

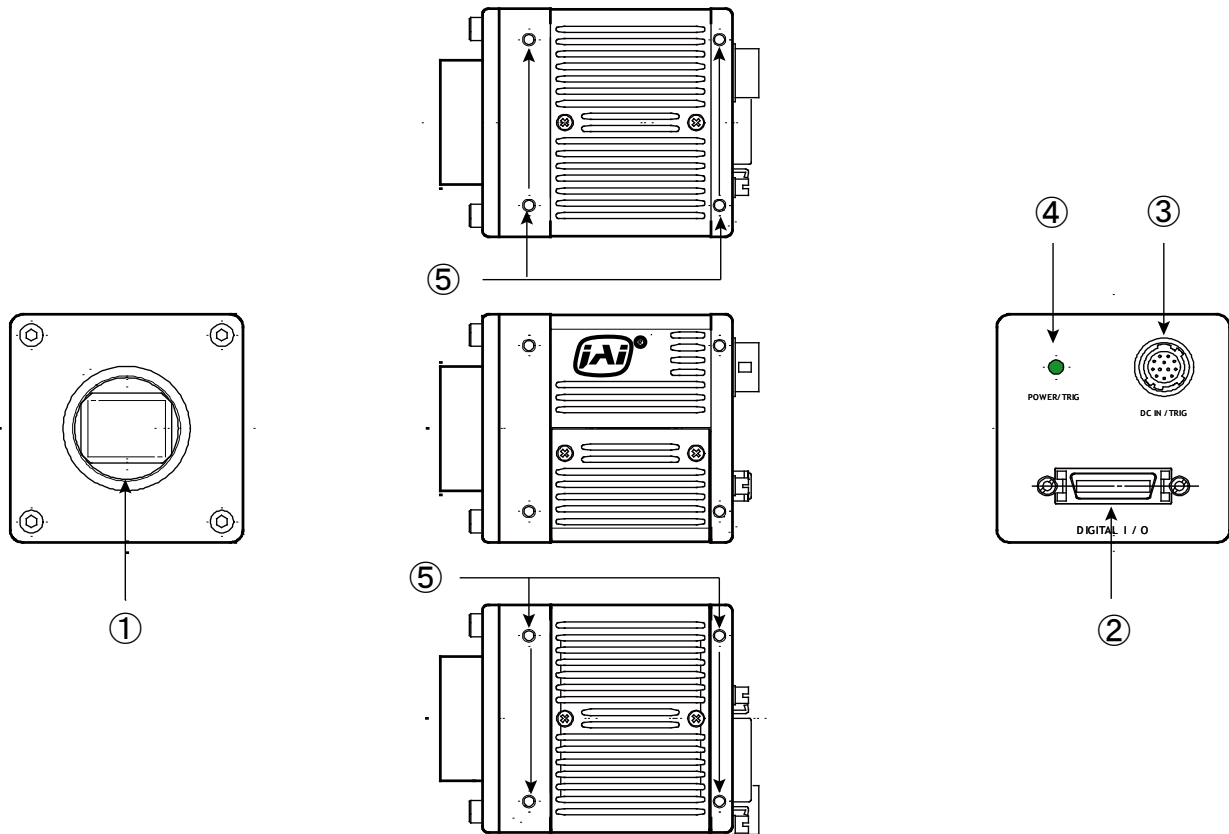
Where A stands for "Advanced" family, B stands for "Bayer mosaic color", 800 represents the resolution "8 million pixel" , CL stands for "Camera Link" interface and C for C-mount lens or F for E-mount lens

3. Main features

- C3 Advanced series 4/3 " progressive scan camera
- Monochrome and Bayer mosaic color versions
- 3296 (h) x 2472 (v) active pixels
- 5µm square pixels
- 57dB or more S/N
- 8-bit, 10-bit or 12-bit output for monochrome and Bayer or 8-bit output RGB color
- 17 frames/second with full resolution in continuous operation for monochrome or Bayer output
- 8.5 frames/second for AB-800CL RGB output (in-camera interpolation)
- Various readout modes, horizontal and vertical binning (AM-800CL only) and AOI (Area Of Interest) modes for faster frame rate
- -3dB to +24dB gain control for AM-800CL and 0dB to +24dB for AB-800CL
- 10µs (1/100,000) to 2 seconds exposure control in 1µs step (Exposure/Timed control mode)
- Timed ,trigger width for exposure control,
- Trigger-dump (RCT) and PIV modes for specific applications
- Auto gain control
- Various pre-processing circuits are provided
 - Programmable LUT
 - Gamma correction from 0.45 to 1.0
 - Flat Field Correction
 - Bayer white balance with manual or one-push auto (AB-800CL only)
 - Bayer color interpolation (AB-800CL only)
 - Blemish compensation
- Test pattern signal generator is built in
- Auto iris lens video output with H-sync
- Choice of lens mounts offered: C-mount or F-mount
- Setup by Windows XP/Vista/7 via serial communication

4. Locations and functions

4.1 Locations and functions (C-mount)



- | | |
|--------------------|---|
| ① Lens mount | C-mount (Note *1) |
| ② 26-pin connector | Camera Link Interface (Note *2) |
| ③ 12-pin connector | DC+12V and trigger input |
| ④ LED | Indication for power and trigger input |
| ⑤ Mounting holes | M3 depth 4.5mm for fixing the camera to the mount plate or tripod mount plate (Note *3) |

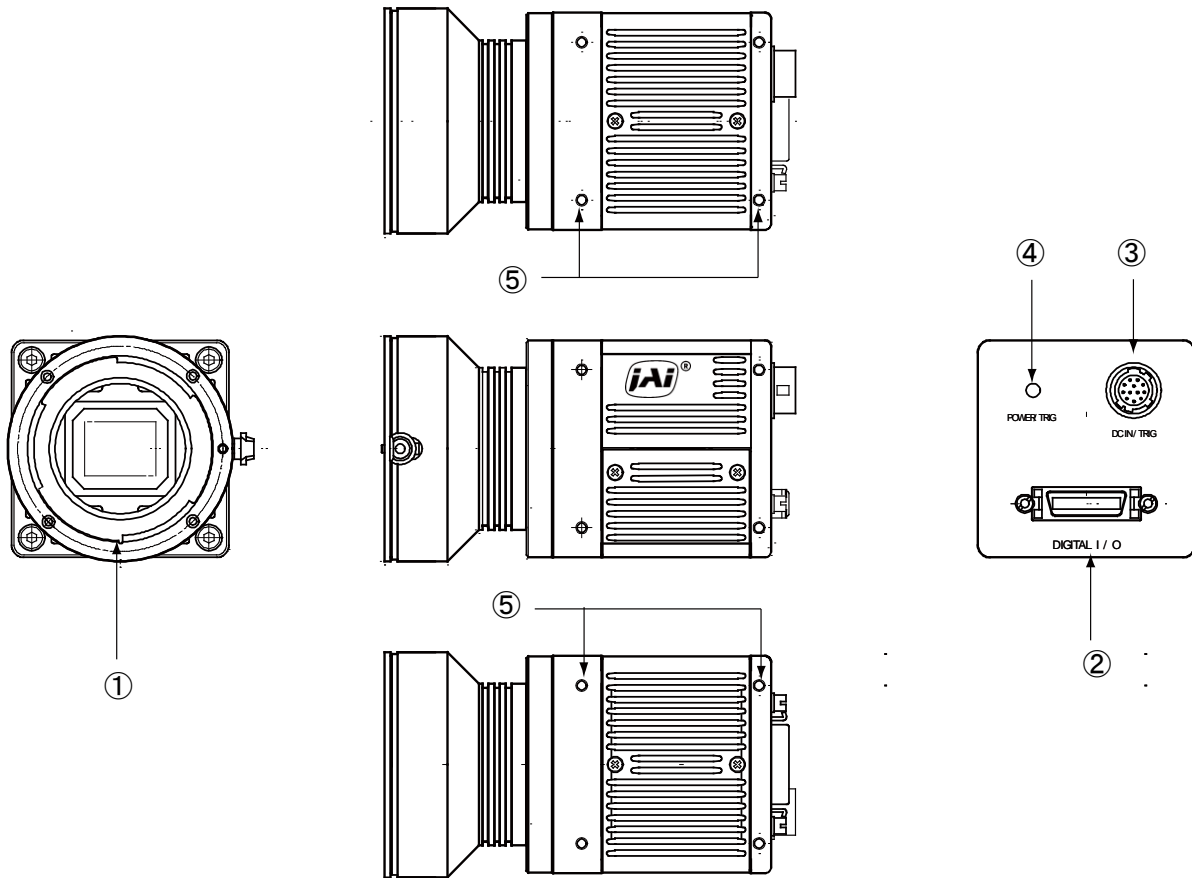
*1) Note: Rear protrusion on C-mount lens must be less than 10.0mm.

*2) Note: When a Camera Link cable is connected to the camera, please do not excessively tighten screws by using a driver. The Camera Link receptacle on the camera might be damaged. For security, the strength to tighten screws is less than 0.291 Newton meter (Nm). Tightening by hand is sufficient in order to achieve this.

*3) Note: The part number for the tripod adapter plate (with 1/4"-20 thread) is MP-41 (option).

Fig. 1 Locations

4.2 Locations and functions (F-mount)



- | | |
|--------------------|---|
| ① Lens mount | F-mount (Note *1) |
| ② 26-pin connector | Camera Link Interface (Note *2) |
| ③ 12-pin connector | DC+12V and trigger input |
| ④ LED | Indication for power and trigger input |
| ⑤ Mounting holes | M3 depth 4.5mm for fixing the camera to the mount plate or tripod mount plate (Note *3) |

*1) Note: Rear protrusion on F-mount lens must be less than 12.0mm.

*2) Note: When a Camera Link cable is connected to the camera, please do not excessively tighten screws by using a driver. The Camera Link receptacle on the camera might be damaged. For security, the strength to tighten screws is less than 0.291 Newton meter (Nm). Tightening by hand is sufficient in order to achieve this.

*3) Note: The part number for the tripod adapter plate (with 1/4"-20 thread) is MP-41 (option).

Fig. 2 Locations

4.3 Rear panel

The rear panel mounted LED provides the following information:

- Amber: Power connected - initiating
- Steady green: Camera is operating in Continuous mode
- ✱ Flashing green: The camera is receiving external triggering

Note: The interval of flashing does not correspond with external trigger duration.

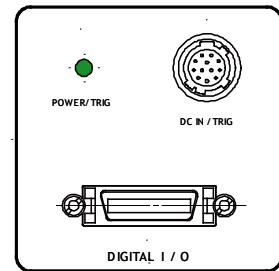


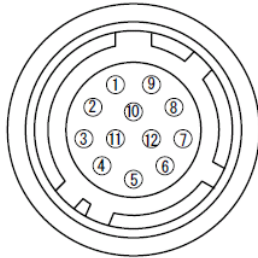
Fig. 3 Rear panel

5. Input and output

5.1 Connectors and pin assignment

5.1.1 Hirose 12Pin connector

5.1.1.1 Figure



Type: HR10A-10R-12PB-01 (Hirose) male.
Use the part number HR10A-10P-12S for the cable side

Fig.4 Hirose 12-pin connector

5.1.1.2 Pin assignment

Pin no.	Signal	Remarks
1	GND	
2	DC input	+12V to +24V
3	GND	
4	Iris video	Only for Continuous and Trigger-dump modes.
5	GND	
6	NC	
7	NC	
8	GND	
9	XEEN out	*1)
10	Trigger in	TI=1 (or Camera Link TI=0). *2)
11	DC input	+12V to +24V
12	GND	

*1) XEEN output can be configured with complementary emitter follower circuit or open collector by internal switch setting. The default is the complementary emitter follower circuit. See chapter 5.1.3 for the details.

*2) Factory default is trigger via Camera Link

5.1.2 Camera Link connector

5.1.2.1 Figure

Type: 26-pin MDR connector (3M 10226-1A10PL)

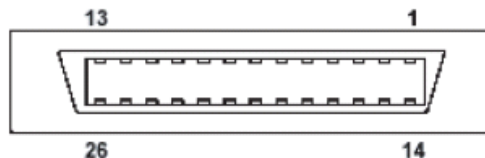


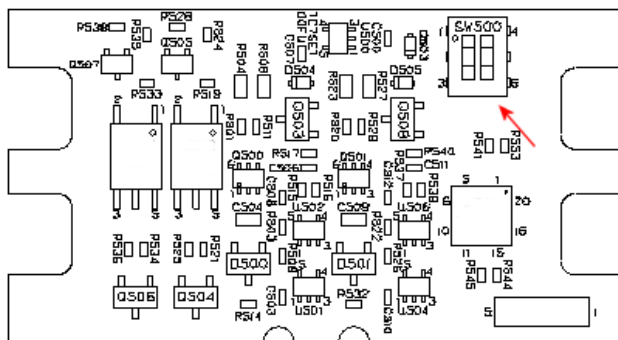
Fig.5 Camera Link connector

5.1.2.2 Pin assignment

Pin No	In/Out	Name	Note
1,14		Shield	GND
2(-),15(+)	O	TxOUT0	Data out
3(-),16(+)	O	TxOUT1	
4(-),17(+)	O	TxOUT2	
5(-),18(+)	O	TxCk	Clock for CL
6(-),19(+)	O	TxOUT3	Data out
7(+),20(-)	I	SerTC (RxD)	LVDS Serial Control
8(-),21(+)	O	SerTFG (TxD)	
9(-),22(+)	I	CC1 (Trigger)	Trigger IN
10(+),23(-)		N.C	
11,24		N.C	
12,25		N.C	
13,26		Shield	GND

5.1.3 DIP switch SW500

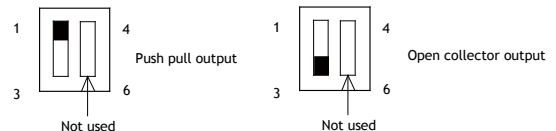
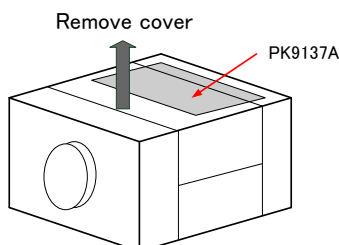
The XEEN output through HIROSE 12-pin #9 can be connected to the complementary emitter follower circuit or the open collector circuit. DIP switch SW500 is used to change circuits. Factory default setting is the complementary emitter follower circuit.



PK9137A

Fig.6 SW500

PK9137A board is located at the top part after removing the top cover.



5.2 Camera Link interface

Port/Signal	2-tap			1-tap	Pin No.
	8bit	10bit	12bit	RGB 8-bit	
Port A0	TAP A0	TAP A0	TAP A0	R0	Tx0
Port A1	TAP A1	TAP A1	TAP A1	R1	Tx1
Port A2	TAP A2	TAP A2	TAP A2	R2	Tx2
Port A3	TAP A3	TAP A3	TAP A3	R3	Tx3
Port A4	TAP A4	TAP A4	TAP A4	R4	Tx4
Port A5	TAP A5	TAP A5	TAP A5	R5	Tx6
Port A6	TAP A6	TAP A6	TAP A6	R6	Tx27
Port A7	TAP A7	TAP A7	TAP A7	R7	Tx5
Port B0	TAP B0	TAP A8	TAP A8	G0	Tx7
Port B1	TAP B1	TAP A9	TAP A9	G1	Tx8
Port B2	TAP B2		TAP A10	G2	Tx9
Port B3	TAP B3		TAP A11	G3	Tx12
Port B4	TAP B4	TAP B8	TAP B8	G4	Tx13
Port B5	TAP B5	TAP B9	TAP B9	G5	Tx14
Port B6	TAP B6		TAP B10	G6	Tx10
Port B7	TAP B7		TAP B11	G7	Tx11
Port C0		TAP B0	TAP B0	B0	Tx15
Port C1		TAP B1	TAP B1	B1	Tx18
Port C2		TAP B2	TAP B2	B2	Tx19
Port C3		TAP B3	TAP B3	B3	Tx20
Port C4		TAP B4	TAP B4	B4	Tx21
Port C5		TAP B5	TAP B5	B5	Tx22
Port C6		TAP B6	TAP B6	B6	Tx16
Port C7		TAP B7	TAP B7	B7	Tx17
LVAL					Tx24
FVAL					Tx25
DVAL					Tx26
EEN					Tx23

5.3 Interface circuits

5.3.1 Iris video output

This signal can be used for lens iris control in Continuous and trigger-dump modes.

The signal for iris video output is taken from the video signal after the gain control. The signal is 1.0 V p-p (with H-sync) from 75 Ω without termination.

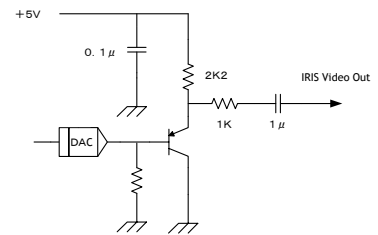


Fig. 7. Iris video

The iris video signal is composed to average the video level in the center area of each frame and can be output as a composite signal with H-sync. As shown in the following figure, each frame has its own video level which is averaged.

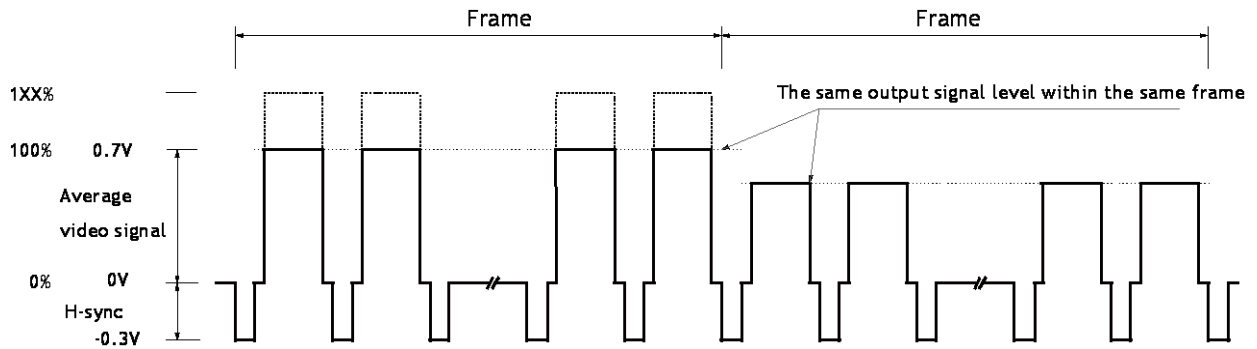


Fig. 8 Iris video output signal

5.3.2 Trigger input

An external trigger input can be applied to pin#10 of the 12-pin Hirose connector (when the command TI=1 has been set). The input is AC coupled. To allow long pulses the input circuit is designed as a flip-flop circuit. The leading and trailing edges of the trigger pulse activate the circuit.

The trigger polarity can be changed by TA(Trigger Activation).

Trigger input level is 4 V \pm 2 V.

Trigger can also be applied through the Camera Link connector, when the command TI=0 has been sent.

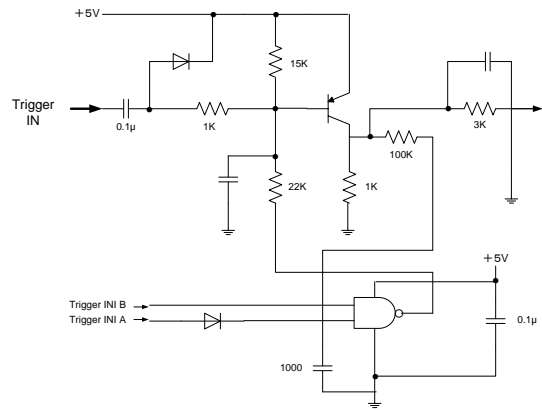


Fig.9 Trigger input circuit

5.3.3 XEEN output

XEEN is on pin#9 of the 12-pin Hirose connector.

The output uses either a complementary emitter follower circuit or open-collector.

The output of the complementary emitter follower circuit is ≥ 3 V (no termination).

When the open collector output is used, the maximum current is 120mA. However, if the current is more than 50mA, use thicker cable for connecting pins #8 and #9. If a thinner cable is used, it might cause a malfunction due to the resistance of the cable.

The output can be selected by switch SW500 located inside the camera (trigger IF board).

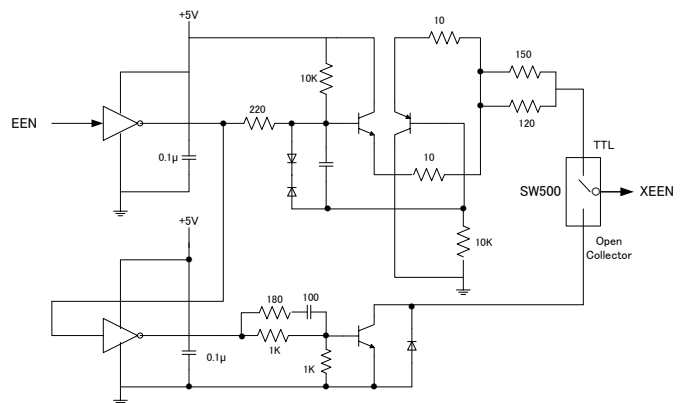


Fig.10 XEEN output from Hirse-12pin

EEN is also found in Camera Link.

5.4 Output

5.4.1 Digital output

5.4.1.1 Bit allocation

CCD out		Analog Out (Equivalent)	Digital Out		
			8bit	10bit	12bit
Black	0%	Setup 3.6%, 25mV	8LSB	32LSB	128LSB
300mV	100%	700mV	222LSB	890LSB	3560LSB
334mV ↑		800mV	255LSB	1023LSB	4095LSB

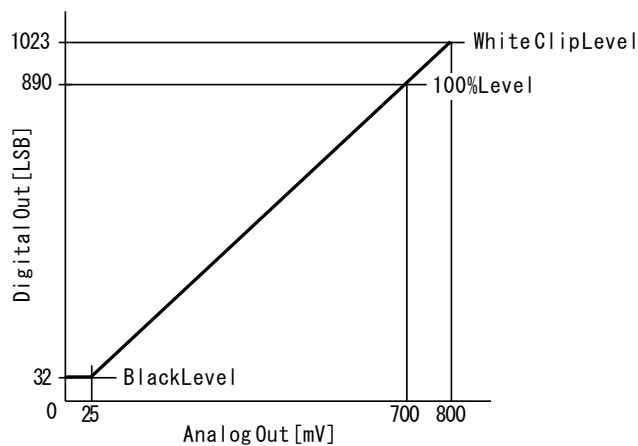


Fig.11 Bit allocation

5.4.1.2 Camera link output

The AM-800CL and AB-800CL have a 4-tap readout from the CCD. The 4-tap output is combined horizontally to output 2 taps through the Camera Link interface.

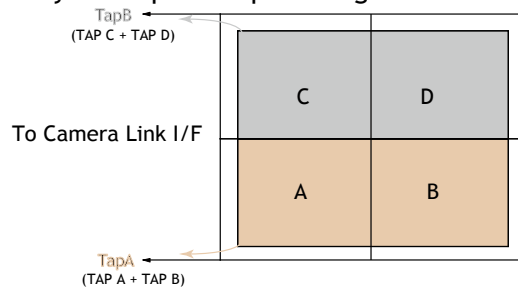


Fig.12 2-tap output

In the case of RGB interpolation, it is provided as 1-tap output.

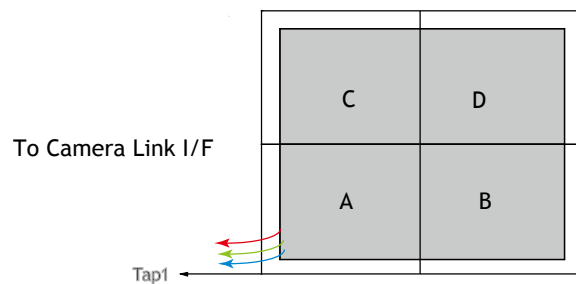


Fig.13 RGB 1-tap output

5.4.2 Partial scan readout (AOI) (Commands: STL, ETL)

The AOI works like partial scanning. By using the AOI function, a faster frame rate can be achieved. The start line of the image (Offset Y) and the image height (Height) can be set as desired. However, the start pixel and/or end pixel of each line cannot be changed. In the AM-800CL and AB-800CL RGB output, The Offset Y and Height can be set in 1 line increments. For the AB-800CL Bayer mode, output can be set in 2-line steps.

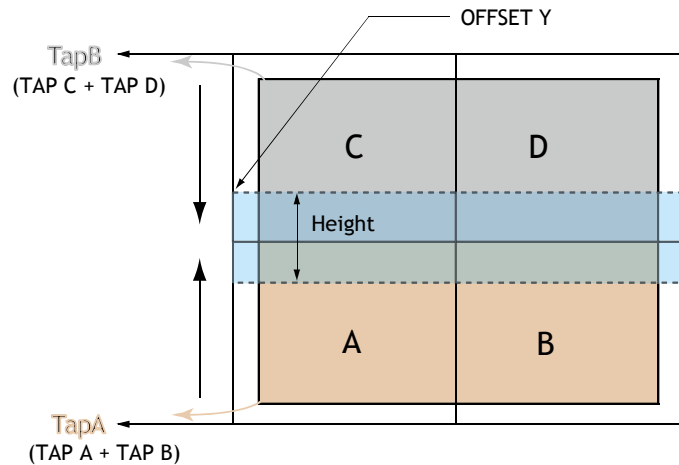


Fig.14 AOI setting

Note for AOI setting

In the AM-800CL and AB-800CL, the frame rate setting has priority. If AOI is used, the frame rate setting should use fewer lines than that of AOI height.

For AOI setting, if the upper TAP and lower TAP have the same duration, the fastest frame rate can be achieved. Thus, if the AOI is centered vertically within the image, the frame rate is maximized. Examples of the settings are shown in sections 5.4.2.4 and 5.4.2.5.

5.4.2.1 Frame rate calculation if AOI is set

The calculation method for the frame rate in AOI mode depends on the setting conditions of offset, height, Bit Allocation and binning control.

It also depends on the position of the readout such as the upper TAP, lower TAP and covering both TAPs.

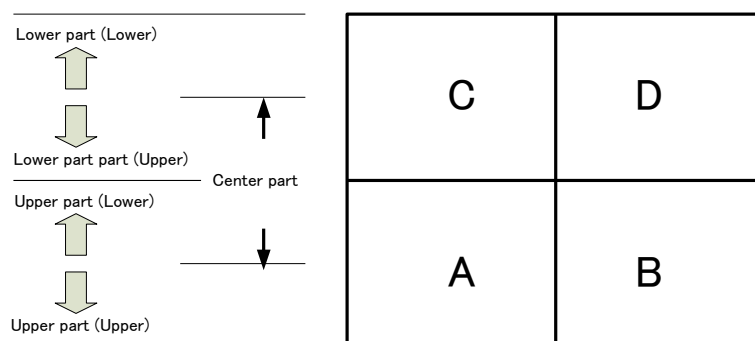


Fig.15 the position of the readout

5.4.2.2 If the bit allocation is set to 8,10 or 12bit and the binning control is OFF or 2x1

- 1) For a centered readout which covers both the upper and lower TAPS
Use the following two formulas to calculate frame lines (A) and frame lines (B).
Use the larger number of frame lines for calculating the frame rate.
If they are the same number of lines, either one can be used.

$$\text{Frame lines (A)} = \text{Roundup}(\text{Offset}/4) + (1236 - \text{Offset}) + 26$$

$$\text{Frame lines (B)} = \text{Roundup}\{[2473 - (\text{Offset} + \text{Height})]/4\} + [(\text{Offset} + \text{Height}) - 1236] + 26$$

$$\text{Frame rate(Hz)} = 1 / (\text{frame lines number} \times 0.00004655)$$

- 2) If the readout is only in the upper TAP
In this case, $\text{Offset} < 1236$ and $(\text{Offset} + \text{Height}) \leq 1236$

$$\text{Roundup}\{(\text{Offset} + 1)/4\} + \{1236 - \text{Roundup}(\text{Offset} + \text{height})/4\} + \text{Height} + 26 = \text{Frame lines number}$$

$$\text{Frame rate (Hz)} = 1 / (\text{Frame number} \times 0.00004655)$$

- 3) If the readout is only in the lower TAP
In this case, $\text{Offset} > 1236$

$$\{2473 - \text{Roundup}[(\text{Offset} + \text{Height})/4]\} + \text{Roundup}(\text{Offset} - 1236) + \text{Height} + 26 = \text{Frame lines number}$$

$$\text{Frame rate(Hz)} = 1 / (\text{Frame lines number} \times 0.00004655)$$

5.4.2.3 If the bit allocation is set to 8,10 or 12bit and the binning control is 1x2 or 2x2

Note: In this case, offset and height should use only even numbers.

- 1) For a centered readout which covers both the upper and lower TAPS
Use the following two formulas to calculate frame lines (A) and frame lines (B).
Use the larger number of frame lines for calculating the frame rate.
If they are the same number of lines, either one can be used.

$$\text{Frame lines (A)} = \text{Roundup}(\text{Offset}/4) + (1236 - \text{Offset}) + 20$$

$$\text{Frame lines (B)} = \text{Roundup}\{[2473 - (\text{Offset} + \text{Height})]/4\} + [(\text{Offset} + \text{Height}) - 1236] + 20$$

$$\text{Frame rate(Hz)} = 1 / (\text{frame lines number} \times 0.0000500655)$$

- 2) If the readout is only in the upper TAP
In this case, $\text{Offset} < 1236$ and $(\text{Offset} + \text{Height}) \leq 1236$

$$\text{Roundup}\{(\text{Offset} + 1)/4\} + \{1236 - \text{Roundup}(\text{Offset} + \text{height})/4\} + \text{Height}/2 + 20 = \text{Frame lines number}$$

$$\text{Frame rate (Hz)} = 1 / (\text{Frame number} \times 0.000050055)$$

- 3) If the readout is only in the lower TAP
In this case, $\text{Offset} > 1236$

$$\{2473 - \text{Roundup}[(\text{Offset} + \text{Height})/4]\} + \text{Roundup}(\text{Offset} - 1236) + \text{Height}/2 + 20 = \text{Frame lines number}$$

$$\text{Frame rate(Hz)} = 1 / (\text{Frame lines number} \times 0.000050055)$$

5.4.2.4 If the bit allocation is set to RGB

In this case, the binning control is not available. So there is only one calculation method.

$$\text{Roundup}\{(\text{Offset} + 1)/4\} + \text{Roundup}\{(2472 - \text{Height} + \text{Offset})/4\} + \text{Height} + 46 = \text{Frame number}$$

$$\text{Frame rate(Hz)} = 1/(\text{Frame lines number} \times 0.00004655)$$

5.4.2.5 Setting example 1

Bit allocation is 8-, 10- or 12-bit and the binning control is OFF or 2x1

AOI	Position	Offset	Height	Frame line	Frame Frequency (Hz)
Full pixels		0	2472	1263	17.01
1/2	Upper TAP	0	1236	1263	17.01
	Center	618	1236	799	26.89
	Lower TAP	1236	1236	1262	17.02
1/4	Upper TAP, upper	0	618	800	26.85
	Upper TAP, lower	616	618	800	26.85
	Center	926	618	568	37.82
	Lower TAP, upper	1236	618	799	26.89
	Lower TAP, lower	1852	618	799	26.89
1/8	Upper TAP, upper	0	310	569	37.75
	Upper TAP, lower	924	310	569	37.75
	Center	1080	310	452	47.53
	Lower TAP, upper	1236	310	568	37.82
	Lower TAP, lower	2160	310	568	37.82
1/16	Upper TAP, upper	0	154	452	47.53
	Upper TAP, lower	1080	154	452	47.53
	Center	1158	154	394	54.52
	Lower TAP, upper	1236	154	451	47.63
	Lower TAP, lower	2316	154	451	47.63

5.4.2.6 Setting example 2

Bit allocation is 8-,10- or 12-bit and the binning control is 1x2 or 2x2)

AOI	Position	Offset	Height	Frame line	Frame Frequency (Hz)
Binning V x2		0	2472	639	30.96
1/2	Upper TAP	0	1236	639	30.96
	Center	618	1236	484	40.87
	Lower TAP	1236	1236	638	31.01
1/4	Upper TAP, upper	0	618	485	40.79
	Upper TAP, lower	616	618	485	40.79
	Center	926	618	407	48.61
	Lower TAP, upper	1236	618	484	40.87
	Lower TAP, lower	1852	618	484	40.87
1/8	Upper TAP, upper	0	310	408	48.49
	Upper TAP, lower	924	310	408	48.49
	Center	1080	310	368	53.76
	Lower TAP, upper	1236	310	407	48.61
	Lower TAP, lower	2160	310	407	48.61
1/16	Upper TAP, upper	0	154	369	53.61
	Upper TAP, lower	1080	154	369	53.61
	Center	1158	154	349	56.68
	Lower TAP, upper	1236	154	368	53.76
	Lower TAP, lower	2316	154	368	53.76

5.4.2.7 Setting example 3

Bit allocation is RGB

Partial	Offset	Height	FrameLine	Frame Frequency
Full	0	2472	2519	8.53
1/2	Any value	1236	1592	13.49
1/4	Any value	618	1129	19.03
1/8	Any value	310	898	23.92
1/16	Any value	154	781	27.51

5.4.3 Binning (Command : BNC) (Only for AM-800CL)

This function is available only for AM-800CL. In binning mode, adjacent pixels in the horizontal direction and/or vertical direction are combined and output as one pixel. The possible combinations are shown below.

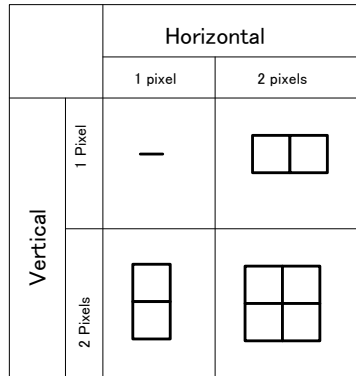


Fig. 16 Binning modes

Binning achieves a higher frame rate, as well as better sensitivity.

On the other hand, the resolution becomes less than the full frame readout.

H x V (Pixels)	Sensitivity	Spatial resolution	
		H direction	V direction
1 x 2	2 times	Unchanged	1/2
2 x 1	2 times	1/2	Unchanged
2 x 2	4 times	1/2	1/2

5.4.4 Bayer output pattern

The AB-800CL starts with GRG on odd lines and BGB on even lines as shown below. If AOI is used, Offset Y can be set every 2 lines and therefore, it always starts with a GRG sequence.

		H1	H2	H3	H4	H5	H6	H7
← signal out	V1	Gr	R	Gr	R	Gr	R	Gr
	V2	B	Gb	B	Gb	B	Gb	B
	V3	Gr	R	Gr	R	Gr	R	Gr

Fig. 17 Bayer sequence

6. Sensor layout and timing

6.1 Sensor layout

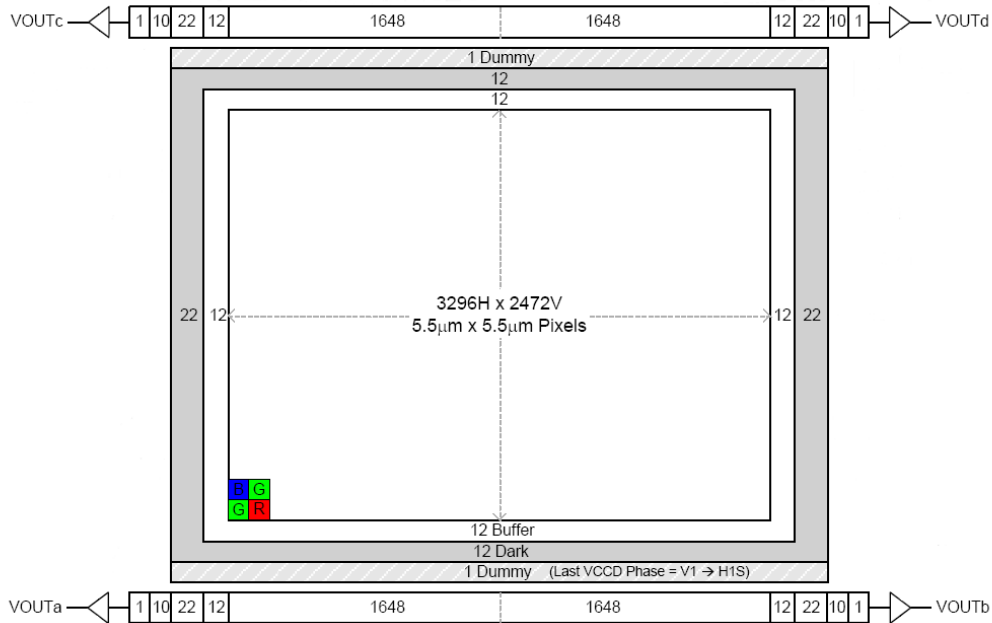


Fig.18 Sensor layout

6.2. Vertical timing (8bit, 10 bit or 12bit for Bit allocation)

6.2.1 If the binning control is BNC=0(OFF) or BNC=2(2x1)

6.2.1.1 AOI default setting (Offset=0, Height=2472)

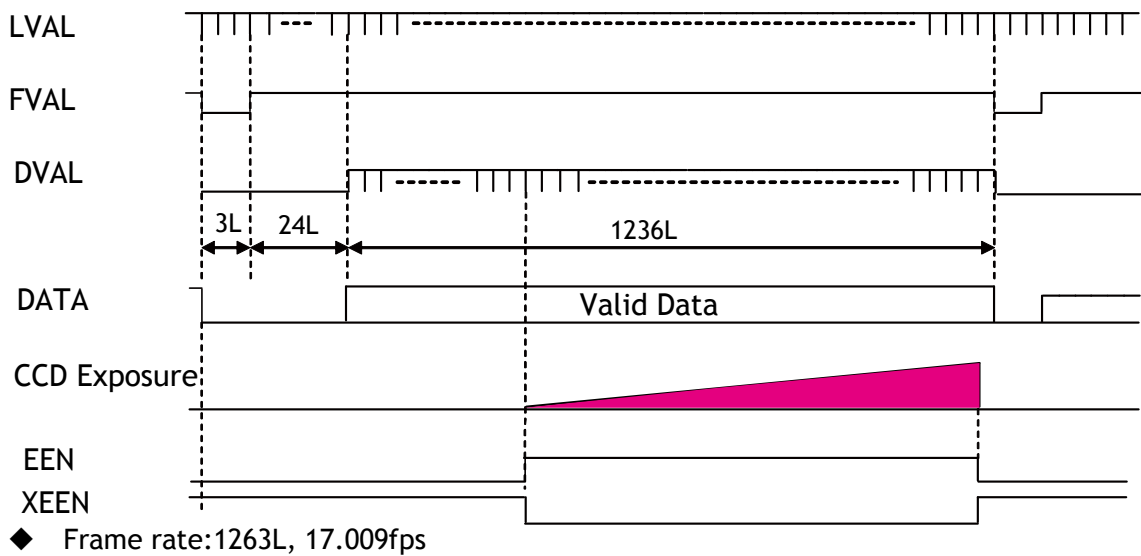
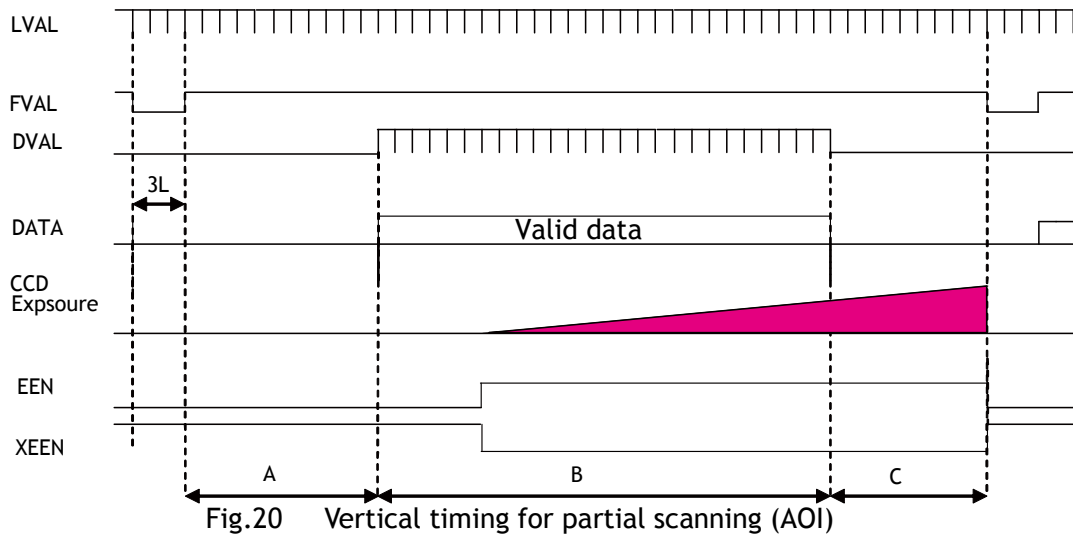


Fig.19 Vertical timing (AOI default)

6.2.1.2 AOI setting



Frame rate examples when the start line and the end line are set as follows

Offset	HEIGHT	A (L)	B (L)	C (L)	Total line (L)	Frame rate (Hz)
618	1236	181	618	0	799	26.89
927	618	258	309	0	567	37.89
309	618	104	618	78	800	26.85
463	309	142	309	116	567	37.89

6.2.2 If the binning control is BNC=1(1x2) or BNC=3(2x2)

6.2.2.1 AOI initial setting (Offset=0, Height=2472)

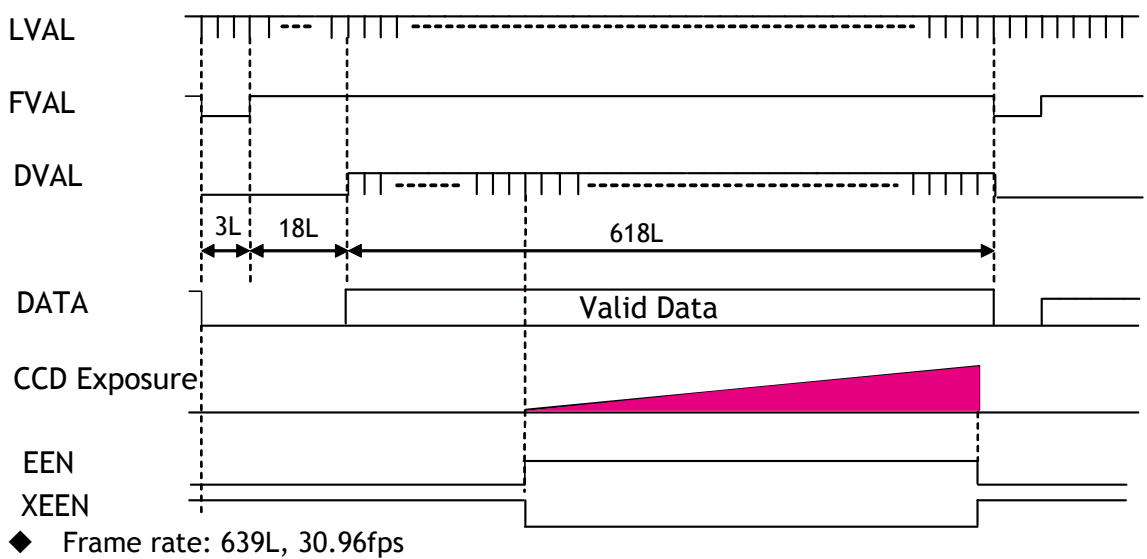


Fig.21 Vertical timing for the vertical binning

6.2.2.2 AOI setting

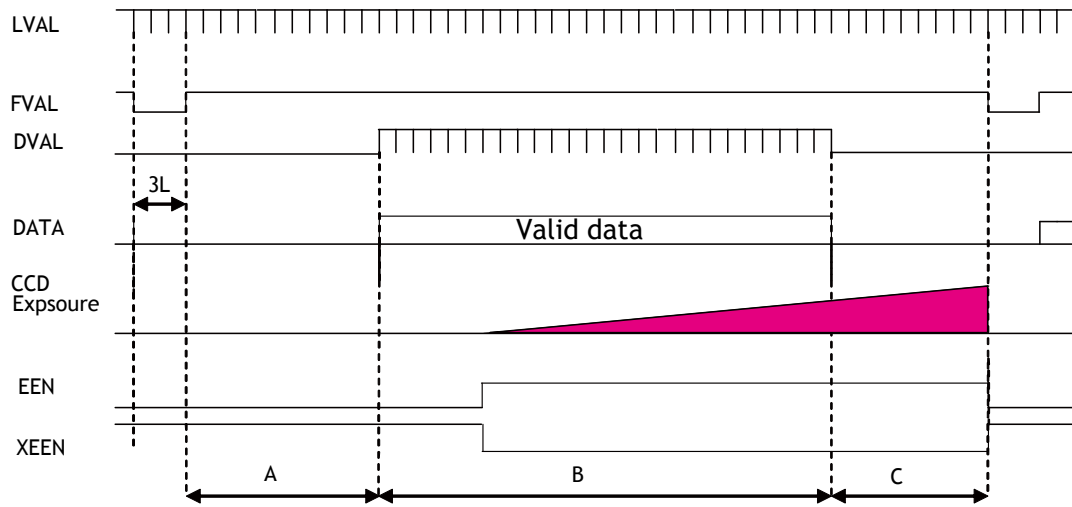


Fig.22 Vertical timing (Vertical binning, AOI setting)

Offset	HEGHT	A (L)	B (L)	C (L)	Total line (L)	Frame rate (Hz)
618	1236	175	309	0	484	40.87
926	618	98	309	0	407	48.61
308	618	98	309	78	485	41.19
462	310	136	155	116	407	49.08

6.3. Vertical timing (Bit allocation = RGB)

6.3.1 AOI initial setting

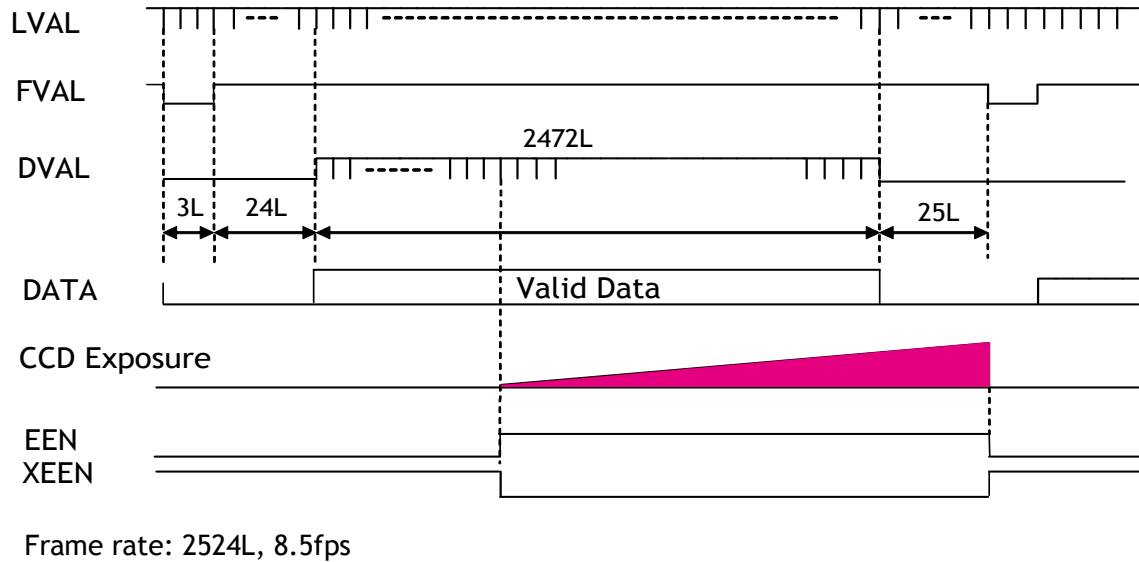


Fig.23 Vertical timing (RGB output mode, AOI setting)

6.3.2 AOI setting

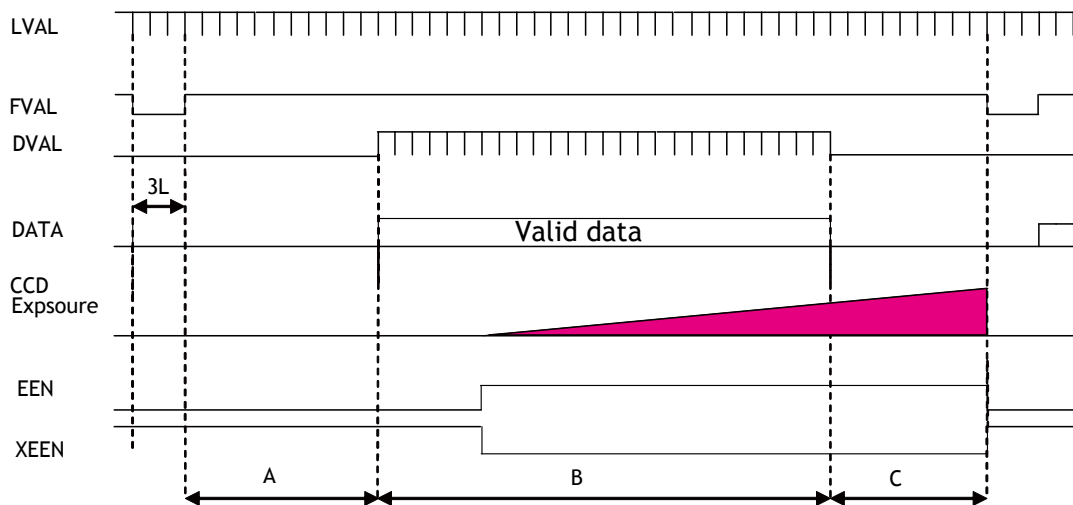


Fig.24 Vertical timing (RGB output mode, AOI setting)

Offset	HEIGHT	A (L)	B (L)	C (L)	Total line (L)	Frame rate (Hz)
412	1648	130	1648	123	1901	11.30
618	1236	181	1236	175	1592	13.49
928	618	259	618	252	1129	19.03
1082	310	297	310	290	897	23.95

6.4. Horizontal timing

6.4.1 If the binning control is 0=OFF or 2=2x1

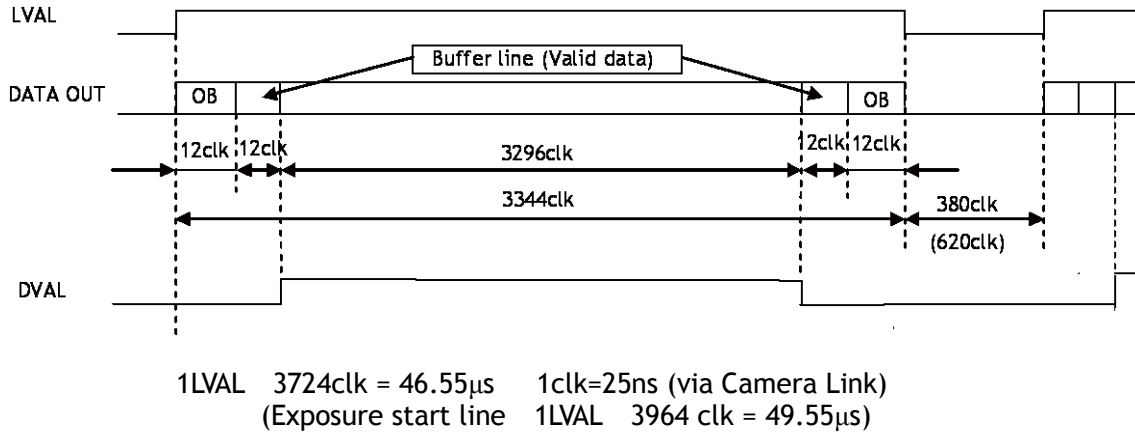


Fig.25 Horizontal timing (Vertical binning OFF)

6.4.2 If the binning control is 1=1x2 or 3=2x2

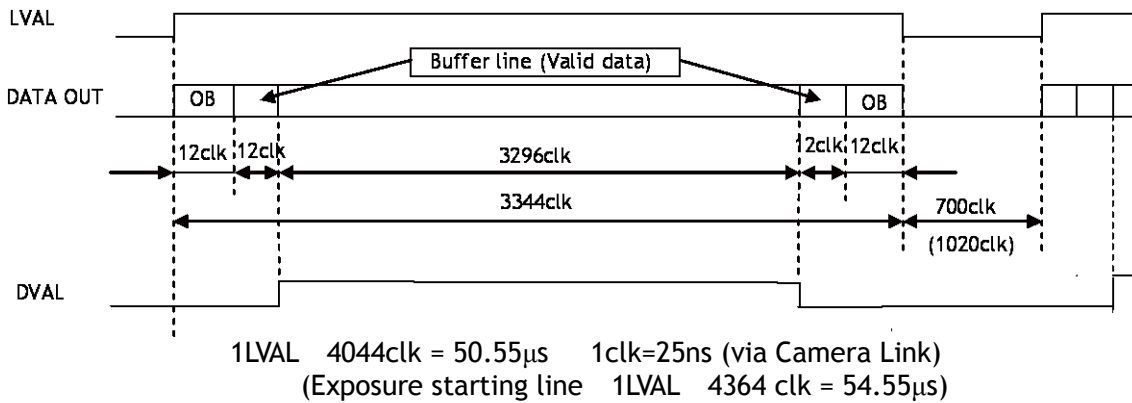


Fig.26 Horizontal timing (Vertical binning ON)

6.4.3 DVAL output if the Binning control is set to 2=2x1 or 3=2x2

If the Binning control is set to 2=2x1 or 3=2x2, DVAL is output in one pixel period within the effective output period. Data is output by adding two pixels in horizontally as described below.

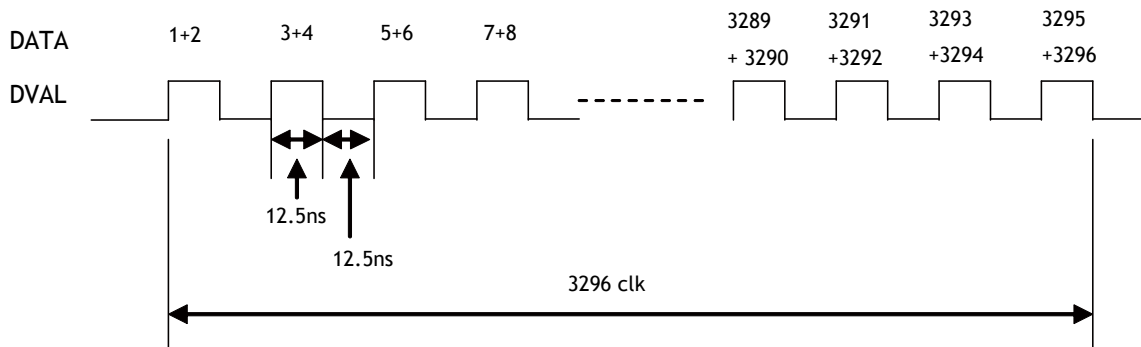


Fig.27 DVAL in the vertical binning

6.4.4 LVAL-LOW level period

- When waiting for a trigger signal or at the exposure start line, LVAL-LOW period varies as shown in the following table.

Binning Control	LVAL-LOW period		LVAL cycle	
	Ordinary	Exposure start	Ordinary	Exposure start
OFF, 2x1	380clk	620clk	3724clk 46.55μs	3964clk 49.55μs
1x2, 2x2	700clk	1020clk	4044clk 50.55μs	4364clk 54.55μs

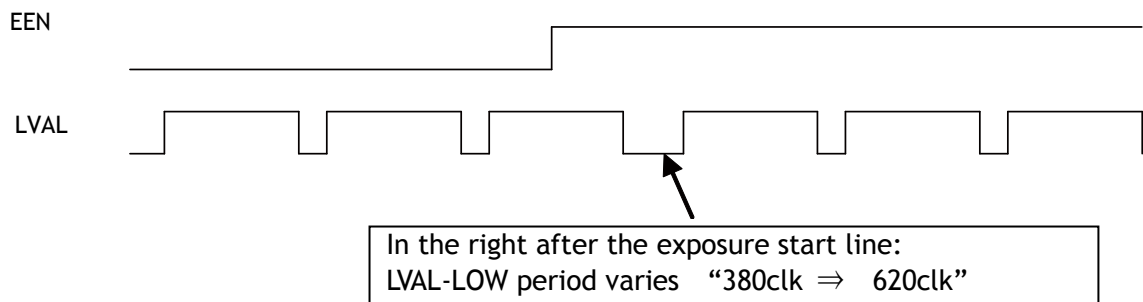


Fig.28 LVAL-LOW period varies

- When the trigger control mode is set to ON and Overlap is set to Readout, LVAL-LOW period is 1LVAL as the maximum.

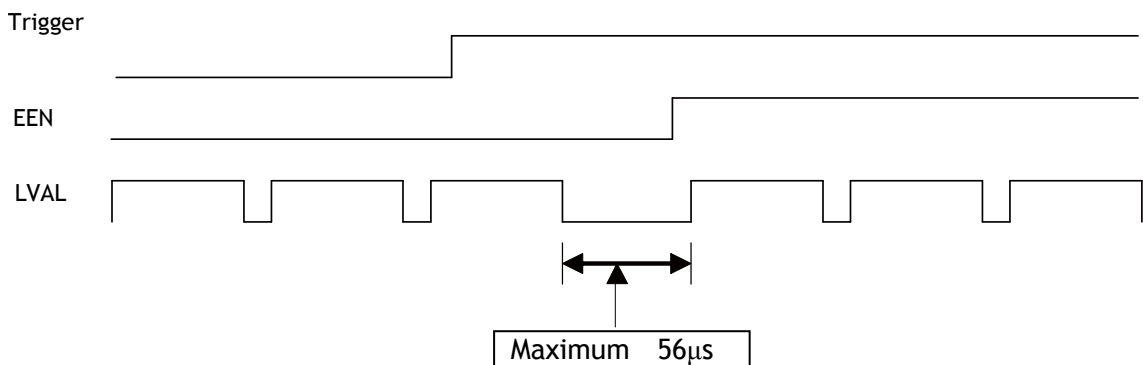
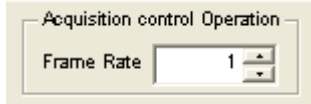


Fig.29 LVAL-LOW period if Overlap is set to Readout

7. Operating modes

The following controls are related to capturing the image.

7.1. Acquisition control (Change the frame rate)

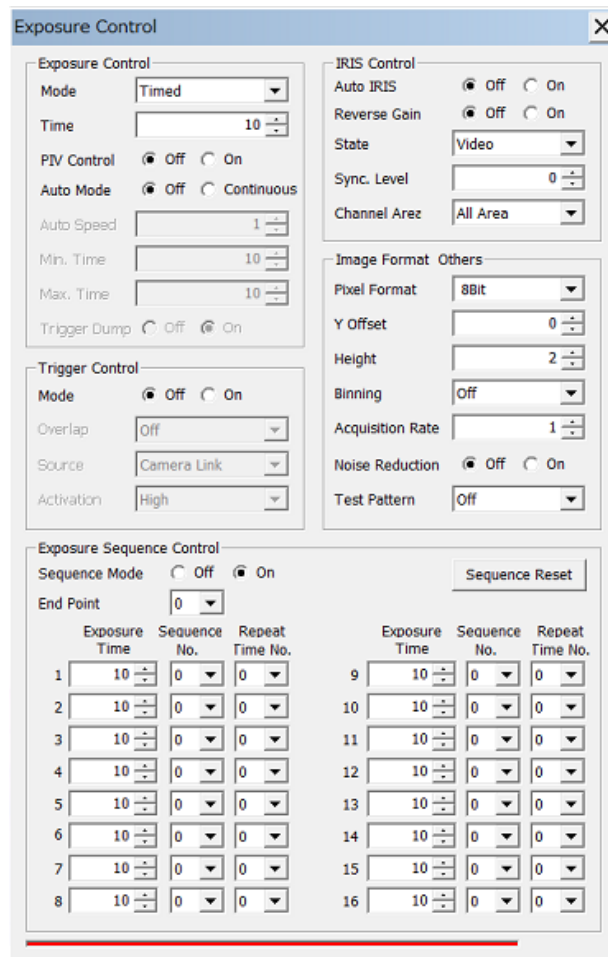


With Exposure Mode set to OFF, the frame rate can be set longer than 1 frame (the normal period needed to capture all pixels). By doing this, the sensitivity of the image can be increased. Maximum recommended exposure time is 2 seconds. This function is available when the trigger mode is OFF.

The setting range is:

Shortest	~	Longest
17.026Hz (1 frame period) (58.7326658ms)	~	0.5Hz (2.0 seconds)

7.2. Exposure setting



7.2.1 Mode

The AM-800CL and AB-800CL have the following exposure modes.

1. EM=0 OFF
2. EM=1 Timed
3. EM=2 Trigger width

7.2.2 Exposure time setting (Command: PE)

PE command can be set if EM (Exposure mode) is set at 1 or 2.

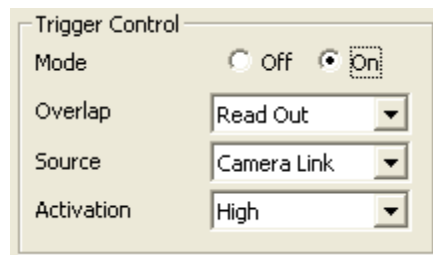
		Minimum exposure time	~	Maximum exposure time
Full pixels		10 μ s	~	2 sec(Note)
Binning (HxV)	1 x 2			
	2 x 1			
	2 x 2			

Note: The AM-800CL and AB-800CL are designed so that frame rate has priority over exposure time. Accordingly, if the exposure time is set at a longer accumulation time than 1 frame (58.7326ms), the frame rate should be set at a longer time than the exposure time.

7.2.3 Exposure sequence (Commands EXSQ, PES(N), PER(N), EXSR, EXSEP, PE1 ~PE16)

Up to 16 exposure settings can be preset as a sequence. Each setting can also be repeated. This function is effective only when the trigger mode is ON, the exposure mode is set to Timed and the exposure sequence is ON.

7.3. Trigger Control



7.3.1 Selection of the trigger input(Command: TI)

The command "TI" can select the trigger input. At TI=0, the input through Camera Link (line 0) is active and at TI=1, the input through the Hirose 12-pin connector is active. The factory default setting is the Camera Link input.

7.3.2 Trigger activation(Command: TA)

The command "TA" can select how to activate the trigger.

- | | | |
|------|--------------|--|
| TA=0 | Rising edge | At the rising edge of the pulse, the accumulation and the readout will start. |
| TA=1 | Falling edge | At the falling edge of the pulse, the accumulation and the readout will start. |
| TA=2 | High | During the high level of trigger, the accumulation is activated and at the low level, the read out is activated. |
| TA=3 | Low | During the low level of trigger, the accumulation is activated and at the high level, the read out is activated. |

7.3.3 Trigger Overlap (Command: TO)

This function sets if a trigger pulse can be accepted while data is being read out or not.

TO=0 OFF : The trigger pulse is not accepted during CCD readout.
This works the same as the LVAL asynchronous mode.

TO=1 Read Out : The trigger pulse can be accepted during CCD readout.
If the trigger pulse is input during CCD readout, it operates as LVAL synchronous and if the trigger is input while the CCD is not being read out, it operates as LVAL asynchronous.

7.3.4 Trigger Dump (Command: TD)

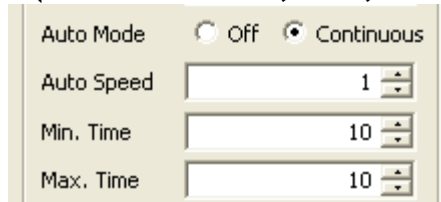
The trigger edge dump has TD=0(disable) and TD=1(enable) modes.

This command can be used with EM=1 (Timed) and it operates the same as RCT mode.

If this mode is “enabled”:

Until the trigger is input, the camera operates continuously and the video signal for the auto-iris lens is output. When the trigger is input, the fast dump is activated to read out the electronic charge very quickly, after which the accumulation and the readout are performed. When the signal is read out, FVAL , LVAL and DVAL are output too.

7.4. Auto shutter control (Commands: ASC,ASCS,ASCEA,ASCEI)



The screenshot shows a control panel for auto shutter control. It includes a radio button for 'Auto Mode' set to 'Continuous' (with 'Off' also visible). Below are three numeric input fields: 'Auto Speed' set to 1, 'Min. Time' set to 10, and 'Max. Time' set to 10. Each field has up and down arrow buttons for adjustment.

This turns the auto exposure function “ON” or “OFF” and provides settings for various parameters.

ASC=0 (OFF), ASC=1 (ON)

ASCS: ASC tracking speed setting. Range is from 1 to 16 (Default is 8).

ASCEA: Maximum exposure time in the ASC mode. Range is from 10 to 1048575 (μ s).

ASCEI: Minimum exposure time in the ASC mode. Range is from 10 to 1048575 (μ s).

This function is available on the continuous operation and trigger-dump ON.

7.5. Normal continuous operation

This is used for applications which do not require triggering. In this mode, the video signal for the auto-iris lens is available.

For the video timing, refer to the chapters 6.2 ,6.3 and 6.4.

The frame rate of full pixels readout is 17.0263fps for AM-800CL and 8.5fps for AB-800CL.

Primary settings to use this mode

Acquisition Frame Rate: AR=1~42964

Trigger control

Trigger mode: TM=0 (OFF)

Exposure settings

Exposure mode: EM=1

Exposure time: PE= 10 μ s ~ 2000000 μ s

or

Select Auto shutter control(ASC)

Exposure time auto: ASC=1 (ON)

Exposure time auto speed : ASCS= 1~16 (Default is 8)

Exposure time auto max: ASCEA= 10 μ s ~ 1048575 μ s

Exposure time auto min: ASCEI= 10 μ s ~ 1048575 μ s

Minimum interval of the image

Readout mode	FULL	2/3 AOI	1/2 AOI	1/4 AOI	1/8 AOI
Minimum frame line	2072	1561	1303	916	724

Note: The AM-800CL and AB-800CL are designed to give priority to the frame rate rather than the exposure time. If the exposure time is set at a longer time than 58.732658ms(1frame time), the frame rate must be set at a longer time than the exposure time.

7.6. Timed mode (so-called EPS operation)

This mode allows a single image frame to be captured with a preset exposure time by using the external trigger. Additional settings determine if the trigger pulse can be accepted during the exposure period.

The frame rate of full pixels readout is 17.0263fps for AM-800CL and 8.5fps for AB-800CL.

Primary settings to use this mode

Acquisition control

Acquisition frame rate: AR= 1~42964

Exposure control

Exposure mode: EM=1 (Timed)

Exposure time: PE=10 μ s ~ 2000000 μ s

Trigger control

Trigger mode: TM=1 (ON)

Trigger overlap: TO=0 (OFF) or 1=(Readout)

OFF: LVALsync Readout: LVALsync/async automatic setting

Trigger source: TI=0 (Camera Link, default) or 1 (Hirose 12-pin)

Trigger Activation: TA=0 (Rising edge), 1= (Falling edge)

Note : The AM-800CL and AB-800CL prioritize the frame rate over the exposure time. If the exposure time is set at longer than 58.73ms (1 frame period), the frame rate must be increased so that it is longer than the exposure time.

Minimum interval of the trigger pulse

Readout mode	FULL	2/3 AOI	1/2 AOI	1/4 AOI	1/8 AOI
Minimum frame lines	2077	1566	1308	921	729

7.6.1 If the overlap setting is "OFF"

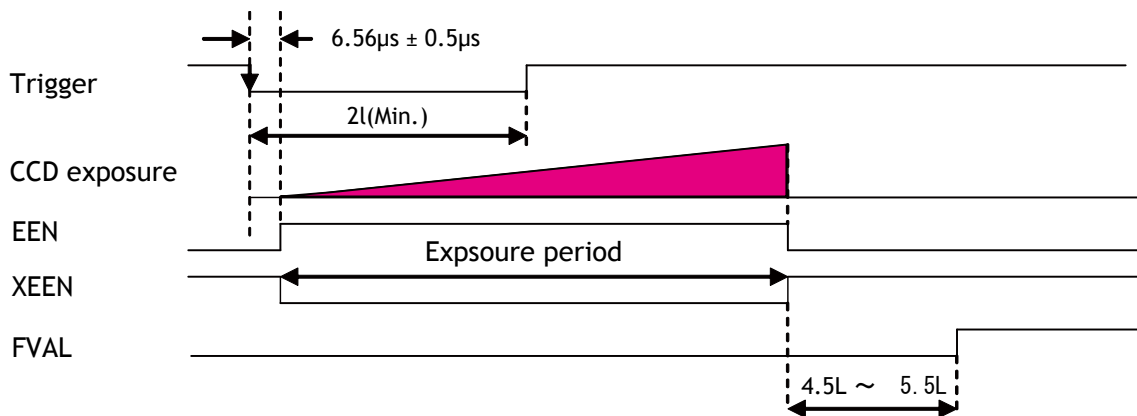


Fig.30 Non Overlap

7.6.2 If the overlap setting is “Readout”

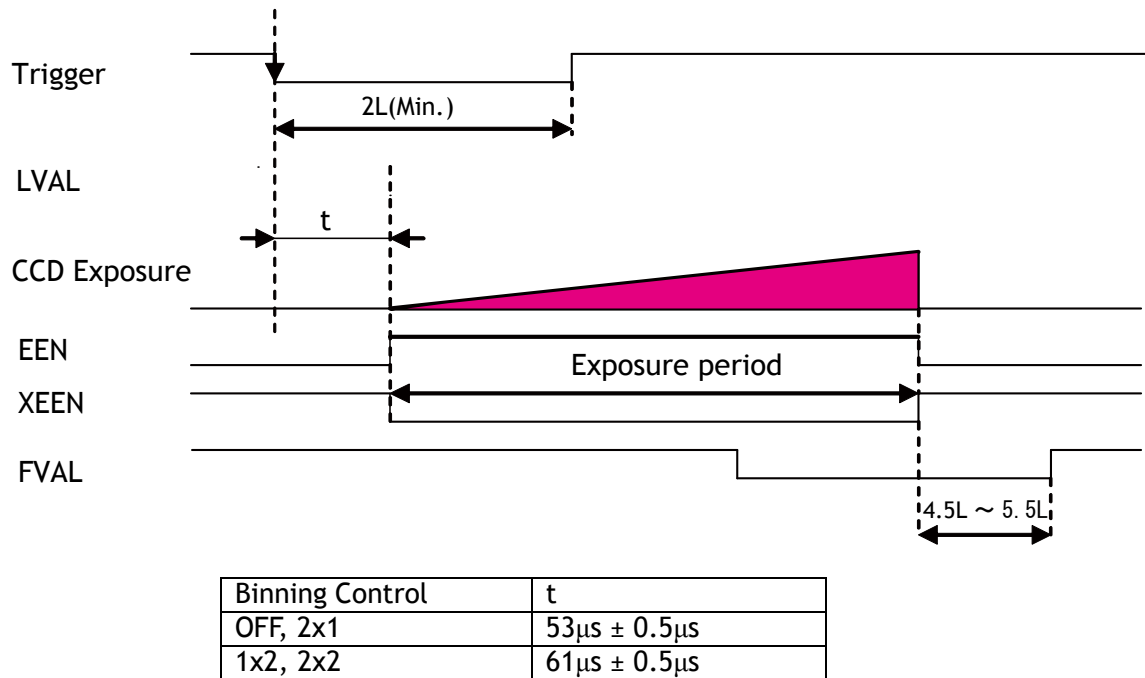


Fig.31 Readout

7.7. Trigger width mode (so-called PWC)

In this mode, the exposure time is equal to the trigger pulse width. Accordingly, longer exposure times are supported. Additional settings determine if the trigger pulse can be accepted during the exposure period.

Primary settings to use this mode

Acquisition control

Acquisition frame rate: AR= 1~42964

Exposure control

Exposure mode: EM=2 (Trigger width)

Trigger control

Trigger mode: TM=1 (ON)

Trigger overlap: TO=0 (OFF) or 1=(Readout)

OFF: LVALsync、Readout:LVALsync/async automatic setting

Trigger source: TI=0 (Camera Link, default) or 1(Hirose 12-pin)

Trigger Activation: TA=0 (Rising edge), 1= (Falling edge) , 2=(Any edge)

Minimum interval of the trigger pulse

Readout mode	FULL	2/3 AOI	1/2 AOI	1/4 AOI	1/8 AOI
Minimum frame lines	2077	1566	1308	921	729

7.7.1 If the overlap setting is “Non Overlap”

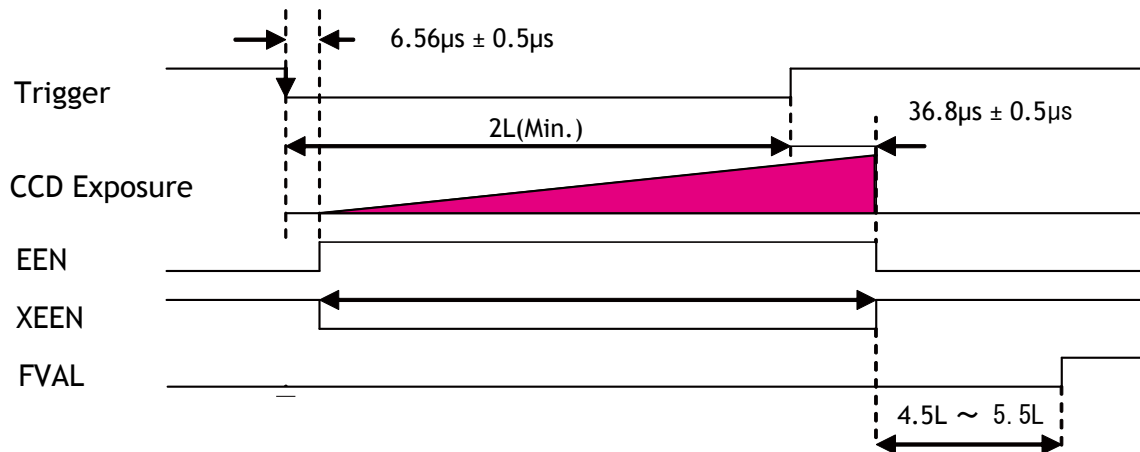


Fig.32 Overlap = OFF

7.7.2 If the overlap setting is “Readout”

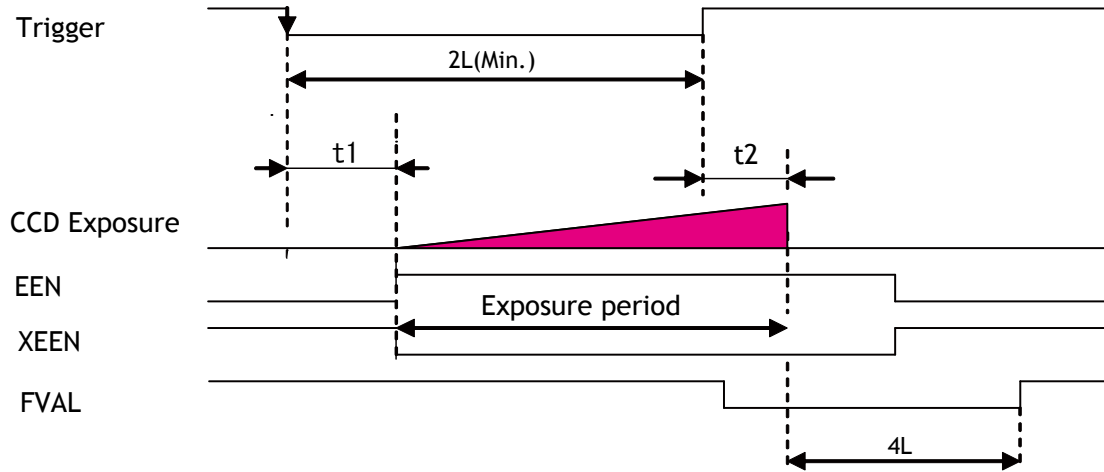


Fig.33 Readout

Binning Control	t1	t2
OFF, 2x1	$53\mu\text{s} \pm 0.5\mu\text{s}$	$83.2\mu\text{s} \pm 0.5\mu\text{s}$
1x2, 2x2	$61\mu\text{s} \pm 0.5\mu\text{s}$	$87.2\mu\text{s} \pm 0.5\mu\text{s}$

7.8. Edge-dump mode (so-called RCT)

Until the trigger is input, the camera operates continuously and the video signal for the auto-iris lens is output. At this moment, the video signal, FVAL and LVAL are output but DVAL is not output. When the trigger is input, the fast dump is activated to read out the electronic charge very quickly, after which the accumulation and the readout are performed. This fast dump period is 17.19ms. When the accumulated signal against the trigger is read out, FVAL, LVAL and DVAL are output too.

The frame rate for full pixels readout is;

AM-800CL is "17.0263fps + Fast dump period + Exposure time"

AB-800CL is "8.5fps + Fast dump period + Exposure time"

Primary settings to use this mode

Acquisition control

Acquisition frame rate: AR= 1~42964

Exposure mode: EM=1 (Timed)

Auto mode: ASC=1 (Continuous)

Trigger dump: TD=1 (Dump ON)

Note : The AM-800CL and AB-800CL gives priority to the frame rate over the exposure time. If the exposure time is set at longer than 58.73ms (1 frame period), the frame rate must be increased so that it is longer than the exposure time.

Minimum interval of the trigger pulse

Readout mode	FULL	2/3 AOI	1/2 AOI	1/4 AOI	1/8 AOI
Minimum frame line	2772	2261	2003	1616	1424

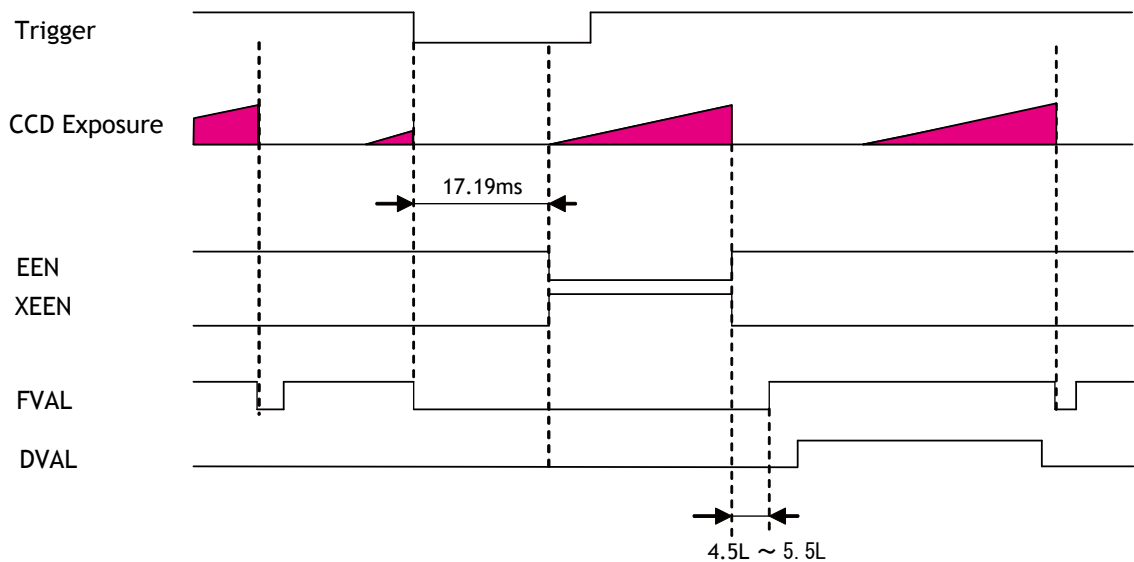


Fig.34 Trigger dump mode timing

7.9. PIV(Particle Image Velocimetry)

The Particle Image Velocimetry mode can be used in applications where 2 images should be taken with a very short time interval. It can only be used with strobe flash as illumination. The first accumulation time is 10 μ sec to 58.73ms. Then, the second exposure will be taken. The accumulation is LVAL asynchronization. The first strobe is activated in the first exposure duration and the second strobe is taken during the first frame being readout. In this way, two strobe lights take two video outputs. The frame rate for full pixels readout is 8.5fps for both AM-800CL and AB-800CL.

Primary Settings

Exposure mode : Timed
 PIV control : ON
 Trigger mode: TM=1 (ON)

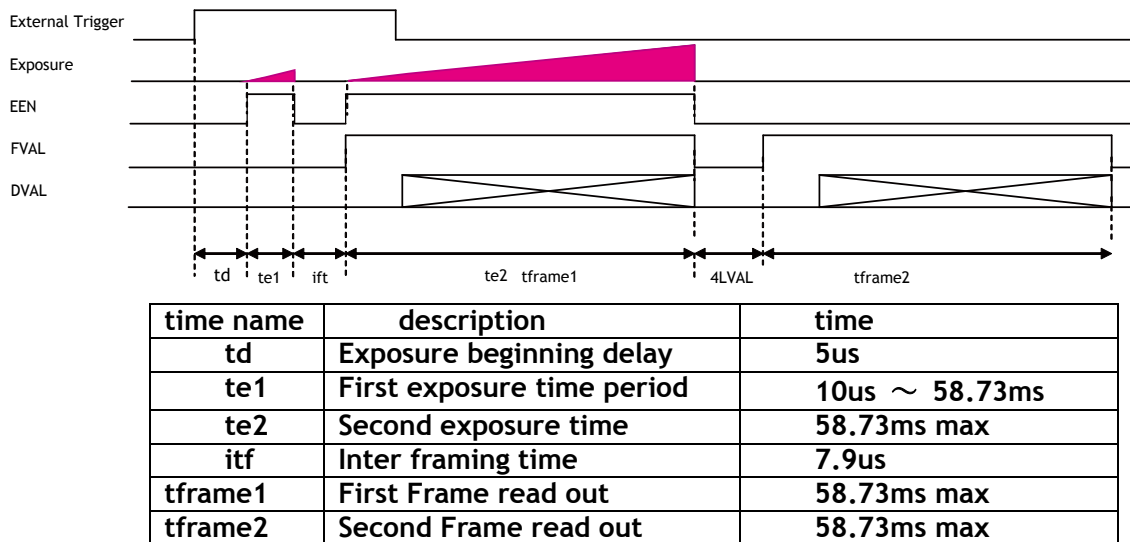


Fig.35 PIV mode

7.10. Operation and function matrix

Operation mode	Exposure control	Expsoure auto	Binning	AOI	Auto Iris output	Overlap	Note
Continuous	○	○	○	○	○	---	
Timed (EPS)	○	×	○	○	×	○	
Trigger width(PWC)	---	×	○	○	×	○	
Trigger Dump (RCT)	○	○	○	○	○	OFF	
JAI_PIV	○	×	○	○	×	OFF	
Exposure Sequence	○	×	○	○	×	OFF	

8. Other functions

8.1 Black level control (Command : BL)

This function adjusts the setup level.

Command value : -1024 to 1023

Variable range : -256 to 255 LSB (at 10-bit output)

8.2 Gain control (Relative commands GA,GJUT1,2,3)

The AM-800CL can adjust the gain level from -3dB to +24dB using 0dB as the reference (Factory default). In the AB-800CL, the master gain can be adjusted from 0dB to +24dB and R and B gains can be adjusted in the range of -7dB to +10dB using the master gain as the reference.

The AM-800CL and AB-800CL has the resolution of $\times 0.00012/\text{step}$ using both analog gain ($0.00359\text{dB}/\text{step}$) and digital gain. In the AB-800CL, blue and red channels can adjust in $\times 0.00012/\text{step}$ by using digital gain.

Refer to the following drawing.

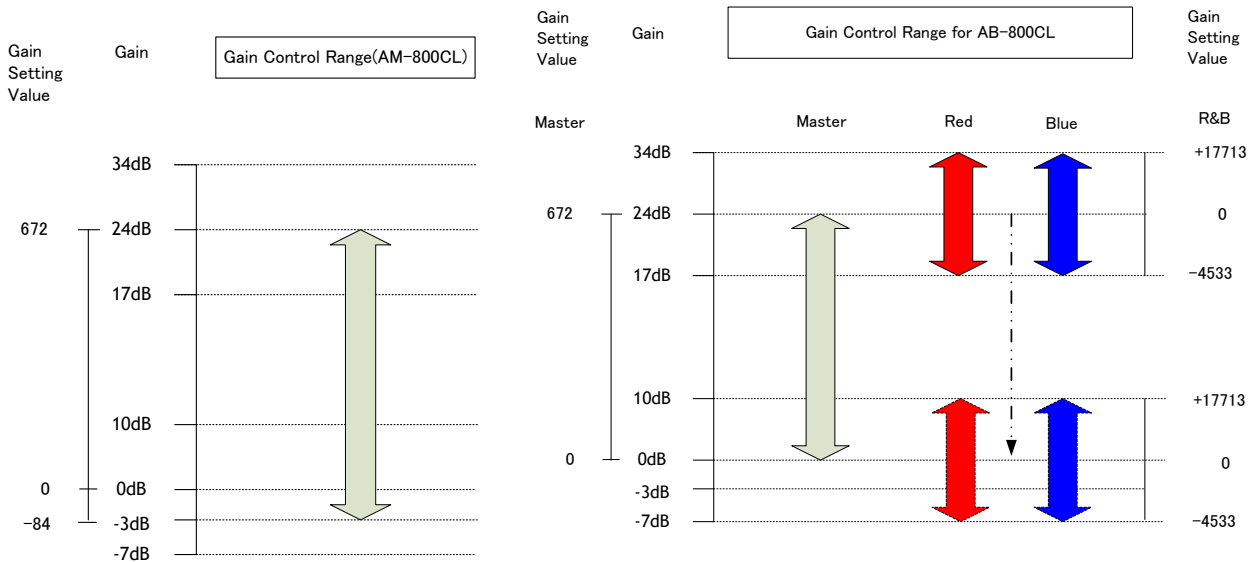


Fig. 36 Gain control

8.3 Tap control (Relative commands AWA,ABA,GJUT1, GJUT2,GJUT3)

The Tap control function adjusts automatically or manually the OFFSET and the gain differences between the upper and lower taps, and the right and left taps. The sensor used in the AM-800CL and AB-800CL divides the effective image area into 4(four) areas as shown in the figure 30 in order to achieve its fast frame rate.

The reference tap for all adjustments is Tap "A".

AWA: Adjust the differences of the gain among taps automatically

ABA: Adjust the differences of the OFFSET among taps automatically

GJUT1: Adjust the gain of the TAP1R(B) manually

GJUT2: Adjust the gain of the TAP2L(C) manually

GJUT3: Adjust the gain of the TAP2R(D) manually

Note: 1) The OFFSET cannot be adjusted individually.

2) TAP A cannot be adjusted individually.

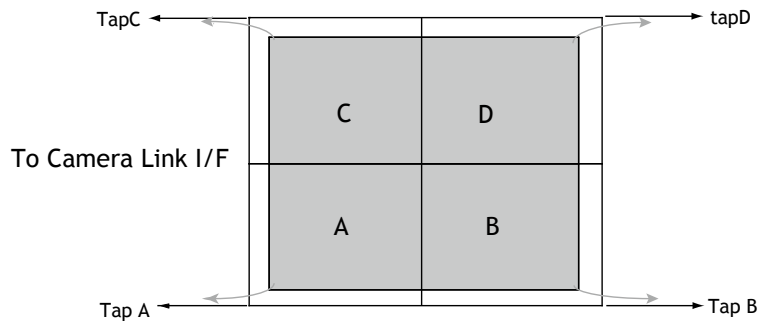


Fig.37 Tap control

8.4. Exposure auto (Related Commands : ASC=1(ON),ASCS,ASCEA,ASCEI)

The exposure can be automatically controlled by setting the command ASC to ON. The adjusting range is 58.733 ms to 10 μ s. The tracking speed can also be set.

	Command	Value
Adjusting range	ASCEA, ASCEI	10 μ s to 58.733ms
Tracking speed	ASCS	1 to 16 (Default:8)

ASCEA: Sets the maximum exposure in the ASC mode

ASCEI: Sets the minimum exposure in the ASC mode

Note: This function works only in continuous mode or edge-dump mode.

8.5. Auto white balance (Related commands:AWB, PGS, PGR, PGGR, PGGB, PGB)

In this function, the gain of each R, Gr, Gb and B color can be individually adjusted to get the proper white balance.

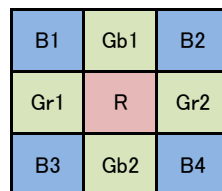


Fig. 38 Auto white balance

To adjust white balance, the AB-800CL has three methods: manual adjustment, one-push auto white balance, and continuous auto white balance.

- AWB: 0 OFF (Manual adjustment)
 1 Once (One-push auto white balance)
 2 Continuous (always tracking)

This function can be used with full resolution read out, as well as with AOI readout. This does not work in trigger mode.

8.6. Blemish compensation

The AM-800CL and AB-800CL have a blemish compensation circuit. This function compensates blemishes on the CCD sensor (typically pixels with extremely high response or extremely low response). This applies to both monochrome and color versions. Pixels that fulfill the blemish criteria can be compensated by adjacent pixels on both columns and, in the case of the AB-800CL, the defective pixels can be compensated by the same Bayer color pixels in both adjacent columns. The number of pixels that can be compensated is up to 64 pixels per tap, for a total of 256 pixels.

The built-in compensation circuit for the AM-800CL and AB-800CL uses compensation data collected in the factory and can be turned ON or OFF. The default setting is OFF.

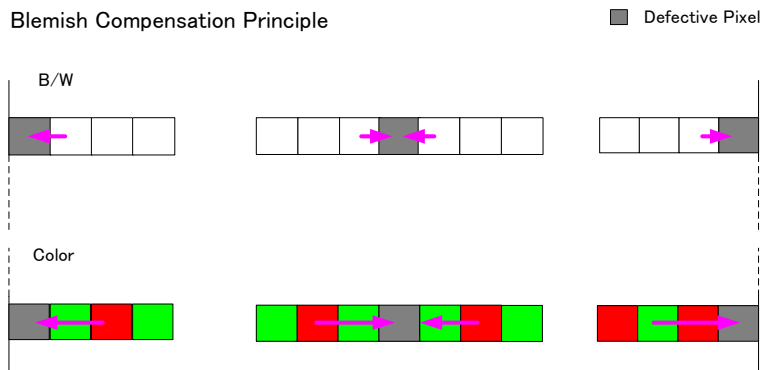


Fig. 39 Blemish compensation

Note: If defective pixels are found consecutively in the horizontal direction, the blemish compensation circuit does not work.

8.7. LUT (Relative commands LUTC,LUTR,LUYG, LUTB)

This function can be used to convert the input to the desired output characteristics. The Look Up Table (LUT) has 256 points for setup and each point has an 8-bit gain value. The output level can be created by multiplying the gain data by the input level. In the AB-800CL, the same LUT characteristic is applied independent of the color value.

If input data is not in the LUT, the weighted mean average data from upper point and the lower point are used.

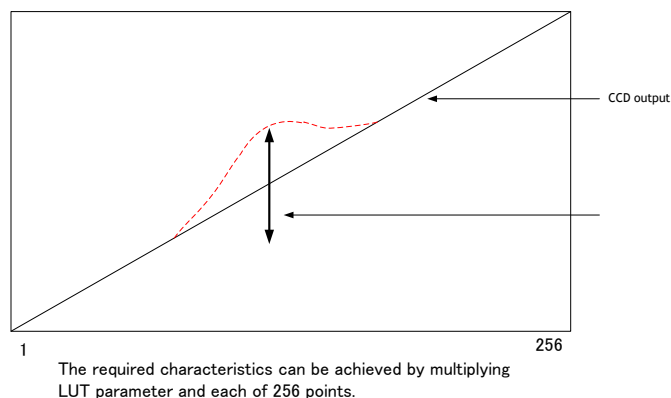


Fig.40 LUT concept drawing

8.8. Gamma (Command: GAMS)

This command is used for the fine tuning of the set gamma characteristics if the gamma is set to 0.45 or 0.6. The parameter of GAMS is 0 to 31 and the default is 16.

If GAMS is 16 (default), the normal 0.45 or 0.6 gamma curve is unaffected. By changing the value of GAMS, the 0.45 or 0.6 gamma curve can be modified.

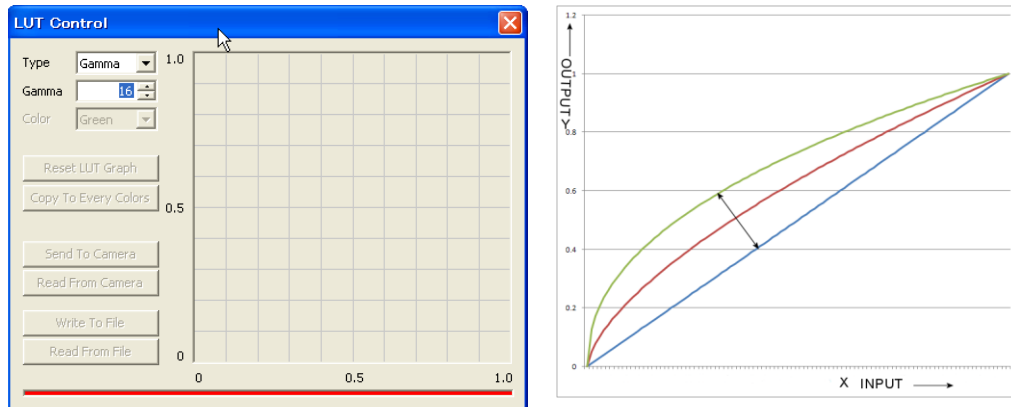


Fig. 41 Gamma compensation

8.9. Flat Field Correction (FFC) (Command: SDR)

This function compensates for shading caused by the lens or the light source used. The method to compensate the shading is to measure the highest luminance level in the image and use that data as the reference. Luminance levels of other areas are then adjusted so that the level of the entire area is equal. The block for compensation is 64 pixels x 64 pixels and the complementary process is applied to produce the compensation data with less error.

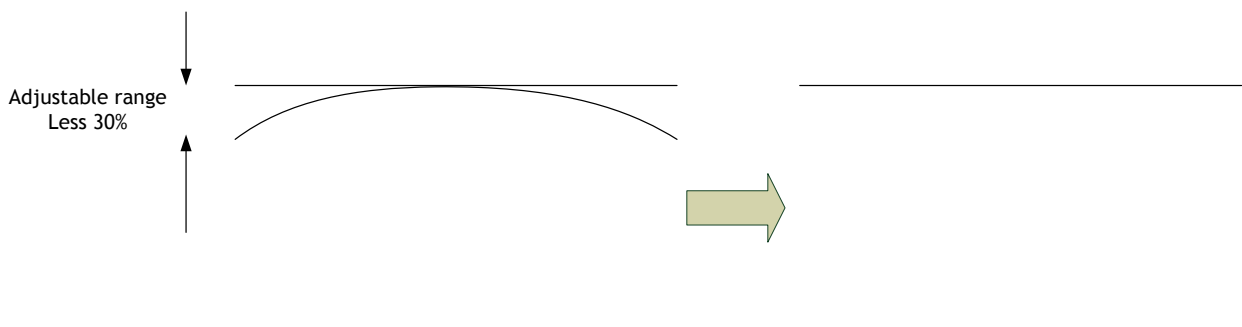


Fig. 42 FFC compensation concept drawing

Note: Under the following conditions, the FFC circuit may not work properly.

- If there is some area in the image with a video level less than 70%
- If part of the image or the entire image is saturated
- If the highest video level in the image is less than 300LSB (at 10-bit output)

SDM: 0=OFF, 1=Factory (Use factory data), 2=User (User setting data)

To generate user data for setting FFC:

Execute the command RS (FFC re-calibration) and store the result in the user area.

8.10. Bayer color interpolation (Command : BCIC) (Only for AB-800CL)

This function is available only for AB-800CL. The AB-800CL uses a CCD with an RGB Bayer pattern. If the Bayer color interpolation is not used, the following RAW data can be output.

B	Gb	B	Gb	B	Gb	B	Gb	B	Gb
Gr	R	Gr	R	Gr	R	Gr	R	Gr	R
B	Gb	B	Gb	B	Gb	B	Gb	B	Gb
Gr	R	Gr	R	Gr	R	Gr	R	Gr	R

Fig.43 Bayer pattern

The RAW data contains only luminance information for each color and outputs as a monochrome signal. The Bayer color interpolation can complement lacking color information on each pixel and output RGB color data as the result. Color interpolation compensates for the lack of color information by using information from adjacent pixels. The following is the concept drawing for the color interpolation process.

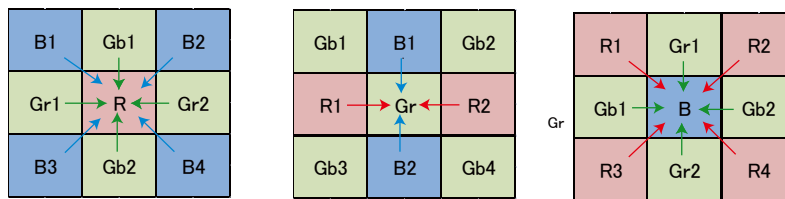
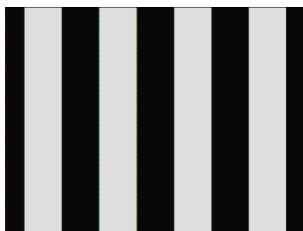


Fig.44 Color interpolation concept drawing

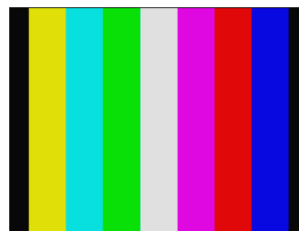
8.11. Test pattern (Command: TPN)

TPN=0 : Test pattern off

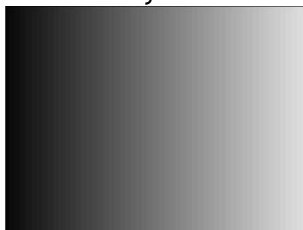
TPN=1 : AM-800:Black-White



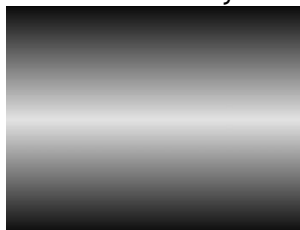
AB-800: Color bar



TPN=2 Gray Pattern1



TPN=3: Gray Pattern2



TPN=4: white (100%)

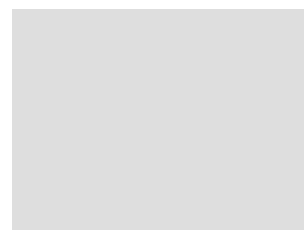


Fig.45 Test pattern

8.12. Temperature sensor (Command : TMPO)

This function reads out the temperature inside the camera.

The measuring range : -55 to +125°C

Resolution : 0.0625 °C

The following table shows examples of values which can be read out by the TMPO command.

TEMPERATURE (°C)	DIGITAL OUTPUT ⁽¹⁾ (BINARY)	HEX
150	0100 1011 0000 0111	4B07
125	0011 1110 1000 0111	3E87
25	0000 1100 1000 0111	0C87
0.0625	0000 0000 0000 1111	000F
0	0000 0000 0000 0111	0007
-0.0625	1111 1111 1111 1111	FFFF
-25	1111 0011 1000 0111	F387
-55	1110 0100 1000 0111	E487

The display resolution in the JAI camera control tool is 1 °C.

9. Configuring the camera

9.1 RS-232C control

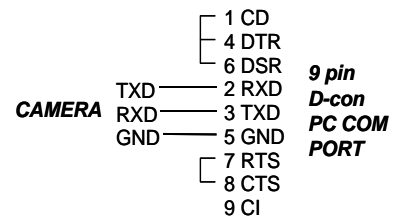
All configuration of the AM-800CL and AB-800CL cameras are done via Camera Link. The camera can be set up from a PC running terminal emulator software, or using JAI's camera control software.

Below is the description of the ASCII based short command protocol.

9.2 Communication setting.

Baud Rate	9600 bps
Data Length	8 bit
Start Bit	1 bit
Stop Bit	1 bit
Parity	None
Xon/Xoff Control	None

RS 232C cable



Protocol.

Transmit setting to camera:

NN=[Parameter]<CR><LF> (NN is any kind of command. Capital or small letters.)

The camera answers:

COMPLETE<CR><LF>

Note: Some commands can only be requested.

To have all communication visible on the emulator screen, start with:

EB=1<CR><LF>

The camera answers:

COMPLETE<CR><LF>

Transmit request command to camera:

NN?<CR><LF> (NN is any kind of command.)

The camera answers:

NN=[Parameter]<CR><LF>

Transmit the following to have the camera's actual settings:

ST?<CR><LF>

The camera answers:

A complete list of the current settings

Transmit the following to have a command list:

HP?<CR><LF>

The camera answers:

A list with all commands and possible settings

Invalid parameters sent to camera: (99 is an invalid parameter)

SH=99<CR><LF>

The camera answers:

02 Bad Parameters!!<CR><LF>

To see firmware number.

VN?<CR><LF>

To see camera ID. It shows the manufacturing lot number.

ID?<CR><LF>

9.3. Save and load functions

The following commands are for storing and loading camera settings in the camera EEPROM.

Load settings. LD.

This command will load previously stored settings to the camera. 3 user settings can be stored in the camera EEPROM. 1 factory setting is also stored in the camera. The settings stored in the last used user area are used as default settings at power up.

Save Settings. SA.

This command will store the actual camera settings to 1 of the 3 user areas in the camera EEPROM.

EEPROM Area. EA.

If received, the camera will return the last used user area number.

9.4 Command list

	Command Name	Format	Parameter	Remarks
A - General settings and utility commands.				
1	Camera Status Request	ST? <CR><LF>		Actual setting
2	Online Help Request	HP? <CR><LF>		Command list
3	Firmware Version	VN? <CR><LF>		3 digits (e.g) 100 = Version 1.00
4	Camera ID Request	ID? <CR><LF>		max 12 characters
5	Model Name Request	MD? <CR><LF>		max 12 characters
6	User ID	UD =[Param.]<CR><LF> UD? <CR><LF>		User can save and load free text.(12 or less characters)
7	Error code	ERRER =[Param.]<CR><LF> > ERRER? <CR><LF>	One of following values will be replied from the camera 0=One-Push has not been finished yet. 1=Succeeded. 2=Error1. Green image was too bright. 3=Error2. Green image was too dark. 4=Error3. Timeout-error occurred.	
B – Image format control				
1	Height	ETL =[Param.]<CR><LF> ETL? <CR><LF>	SC=1: :2 to 2472	AB-800 : 2Line step AM-800 : 1Line step
2	Offset Y	STL =[Param.]<CR><LF> STL? <CR><LF>	SC=1: :1 to 2471	AB-800 : 2Line step AM-800 : 1Line step
3	Binning Vertical	BNC =[Param.]<CR><LF>	0=off	Only AM-800CL

AM-800CL / AB-800CL

	Command Name	Format	Parameter	Remarks
		BNC?<CR><LF>	1=1x2, 2=2x1 3=2x2	
4	PixelFormat	BA =[Param.]<CR><LF> BA?<CR><LF>	0=8bit, 1=10bit, 2=12bit, 3=RGB	
C – Test image selector				
1	Test Image selector	TPN =[Param.]<CR><LF> TPN?<CR><LF>	0=OFF 1=Color bar (AB-xxx) / Black-White (AM-xxx) 2= Gray horizontal ramp 3= Gray Vertical ramp 4= White	
D – Acquisition control				
1	Acquisition Frame Rate	AR =[Param.]<CR><LF> AR?<CR><LF>	1 to 42964	
E – Trigger control				
1	Trigger Mode	TM =[Param.]<CR><LF> TM?<CR><LF>	0=off 1=on	
2	Trigger source	TI =[Param.]<CR><LF> TI? <CR><LF>	0= Line0(Camera Link) 1= Line1(Hirose 12pin)	
3	Trigger Activation	TA =[Param.]<CR><LF> TA? <CR><LF>	0= Rising edge 1=Falling edge 2=High 3=Low	
4	Trigger overlap	TO =[Param.]<CR><LF> TO?<CR><LF>	0= off 1= Read out	
F – Exposure control				
1	Exposure Mode	EM =[Param.]<CR><LF> EM?<CR><LF>	0=OFF 1=Timed 2=Trigger width	
2	Exposure time	PE =[Param.]<CR><LF> PE?<CR><LF>	10μs ~ 2000000μs	Available when EM=1,2
3	ExposureAuto	ASC =[Param.]<CR><LF> ASC?<CR><LF>	0=off, 1=Continuous	
4	ExposureAuto speed	ASCS =[Param.]<CR><LF> ASCS?<CR><LF>	1 to 16	ASC Tracking speed setting, Default=8
5	ExposureAuto Max	ASCEA =[Param.]<CR><LF> > ASCEA?<CR><LF>	10 to 1048575 us unit	Maximum Exposure value when ASC is 1
6	ExposureAuto Min	ASCEI =[Param.]<CR><LF> > ASCEI?<CR><LF>	10 to 1048575 us unit	Minimum Exposure value when ASC is 1

	Command Name	Format	Parameter	Remarks
7	Trigger edge Dump	TD =[Param.]<CR><LF> TD? <CR><LF>	0= Dump off 1=Dump on	
G – Analog control				
1	GainAnalog All	GA =[Param.]<CR><LF> GA?<CR><LF>	-84 to 672 (AM-xxxCL) 0 to 672 (AB-XXXCL)	for AFE 1L, 1R, 2L, 2R
2	FineGain Digital All	FGA =[Param.]<CR><LF> FGA?<CR><LF>	-2393~3379 (Data+8192)/ 8192 ±3dB	for AFE 1L, 1R, 2L, 2R
3	Gain Auto	AGC =[Param.]<CR><LF> AGC?<CR><LF>	0=OFF 1=Continuous	
4	Gain Auto Reference	AGCF =[Param.]<CR><LF> AGCF?<CR><LF>	0 to 8192	
5	Gain Auto speed	AGCS =[Param.]<CR><LF> AGCS?<CR><LF>	1 to 16	AGC tracking speed Setting ,Default=8
6	Gain Auto Maximum gain value	AGCGA =[Param.]<CR><LF> AGCGA?<CR><LF>	0 to 672 (AM-xxxCL) 84 to 672 (AB-XXXCL)	
7	Gain Auto Minimal gain value	AGCGI =[Param.]<CR><LF> AGCGI?<CR><LF>	-84 to 588 (AM-xxxCL) 0 to 588 (AB-XXXCL)	
8	Black Level	BL =[Param.]<CR><LF> BL?<CR><LF>	-1024 to 1023	Digital User Setup Master
H – Balance Ratio				
1	BalanceRatio RED	PGR =[Param.]<CR><LF> PGR?<CR><LF>	-4533~17713 (Data+8192)/ 8192 -7~+10dB	(Only AB-800CL) Pixel Gain for WB
2	BalanceRatio Blue	PGB =[Param.]<CR><LF> PGB?<CR><LF>	-4533~17713 (Data+8192)/ 8192 -7~+10dB	(Only AB-800CL) Pixel Gain for WB
3	Balance White auto	AWB =[Param.]<CR><LF>	0=OFF 1=Once (Run) 2=Continuous	Only AB-800CL
4	Request the Result of Balance white auto	AWRS?<CR><LF>	0=Complete. 1=Too Bright. 2=Too dark. 3=Timeout Error. 4=Busy. 5=Limit. 6= Trig is not set as Normal.	Only AB-800CL
I – LUT control				
1	LUT selector	LUTC =[Param.]<CR><LF>	0=off	

AM-800CL / AB-800CL

	Command Name	Format	Parameter	Remarks
		LUTC?<CR><LF>	1=Gamma 2=LUT	
2	Gamma Selector	GAMS=[Param.]<CR><LF> GAMS?<CR><LF>	0 to 16	(Only Gamma)
3	LUT data communication for Red	LUTR=[Param.]<CR><LF> LUTR?<CR><LF>	transfer by a serial method. The number of the data is 512. Param=0 to 8191	After sending consecutive 512 data, LUT data can be renewed
4	LUT data communication for Green	LUTG=[Param.]<CR><LF> LUTG?<CR><LF>	transfer by a serial method. The number of the data is 512. Param=0 to 8191	After sending consecutive 512 data, LUT data can be renewed
5	LUT data communication for Blue	LUTB=[Param.]<CR><LF> LUTB?<CR><LF>	transfer by a serial method. The number of the data is 512. Param=0 to 8191	After sending consecutive 512 data, LUT data can be renewed
J – Gain and black level for TAP balance				
1	Gain auto Tap Balance	AWA=[Param.]<CR><LF>	0=OFF 1=Once(Run) 2=Continuous	
2	Request the Result of Gain auto Tap balance	WBRS?<CR><LF>	0=Complete. 1=Too Bright. 2=Too dark. 3=Timeout Error. 4=Busy. 5=Limit. 6= Trig is not set as Normal.	
3	Fine Gain for Tap 2	GJUT2=[Param.]<CR><LF> GJUT2?<CR><LF>	-891~1000 (Data+8192)/ 8192 ±1dB	for pixel Gain 1R
4	Fine Gain for Tap 3	GJUT3=[Param.]<CR><LF> GJUT3?<CR><LF>	-891~1000 (Data+8192)/ 8192 ±1dB	for pixel Gain 2L
5	Fine Gain for Tap 4	GJUT4=[Param.]<CR><LF> GJUT4?<CR><LF>	-891~1000 (Data+8192)/ 8192 ±1dB	for pixel Gain 2R
6	PixelGain RED Tap2	PGR2=[Param.]<CR><LF> PGR2?<CR><LF>	-891~1000 (Data+8192)/ 8192 ±1dB	(Only AB-800CL) Pixel Gain for Tap2
7	Pixel Gain Blue Tap2	PGB2=[Param.]<CR><LF> PGB2?<CR><LF>	-891~1000 (Data+8192)/ 8192	(Only AB-800CL) Pixel Gain for Tap2

	Command Name	Format	Parameter	Remarks
			$\pm 1\text{dB}$	
8	Pixel Gain RED Tap3	PGR3 =[Param.]<CR><LF> PGR3? <CR><LF>	-891~1000 (Data+8192)/ 8192 $\pm 1\text{dB}$	(Only AB-800CL) Pixel Gain for Tap3
9	Pixel Gain Blue Tap3	PGB3 =[Param.]<CR><LF> PGB3? <CR><LF>	-891~1000 (Data+8192)/ 8192 $\pm 1\text{dB}$	(Only AB-800CL) Pixel Gain for Tap3
10	Pixel Gain RED Tap4	PGR4 =[Param.]<CR><LF> PGR4? <CR><LF>	-891~1000 (Data+8192)/ 8192 $\pm 1\text{dB}$	(Only AB-800CL) Pixel Gain for Tap4
11	Pixel Gain Blue Tap4	PGB4 =[Param.]<CR><LF> PGB4? <CR><LF>	-891~1000 (Data+8192)/ 8192 $\pm 1\text{dB}$	(Only AB-800CL) Pixel Gain for Tap4
12	Black level auto Tap balance	ABA =[Param.]<CR><LF>	0=OFF 1=Once (Run) 2=Continuous	
13	Request the Result of Black level auto Tap balance	BBRS? <CR><LF>	0=Complete. 1=Too Bright. 2=Too dark. 3=Timeout Error. 4=Busy. 5=Limit. 6= Trig is not set as Normal.	
14	Fine Black for tap 2	BL2 =[Param.]<CR><LF> BL2? <CR><LF>	-512 to 511	Tap2 Black Fine For User
15	Fine Black for tap 3	BL3 =[Param.]<CR><LF> BL3? <CR><LF>	-512 to 511	Tap3 Black Fine For User
16	Fine Black for tap 4	BL4 =[Param.]<CR><LF> BL4? <CR><LF>	-512 to 511	Tap4 Black Fine For User
17	BayerPixel FineBlack for tap 1L-R	BLR1 =[Param.]<CR><LF> BLR1? <CR><LF>	-512 to 511	Tap1 Black Fine For User
18	BayerPixel FineBlack for tap 1L-B	BLB1 =[Param.]<CR><LF> BLB1? <CR><LF>	-512 to 511	Tap1 Black Fine For User
19	BayerPixel FineBlack for tap 1R-R	BLR2 =[Param.]<CR><LF> BLR2? <CR><LF>	-512 to 511	Tap2 Black Fine For User
20	BayerPixel FineBlack for tap 1R-B	BLB2 =[Param.]<CR><LF> BLB2? <CR><LF>	-512 to 511	Tap2 Black Fine For User
21	BayerPixel	BLR3 =[Param.]<CR><LF>	-512 to 511	Tap3 Black Fine For

AM-800CL / AB-800CL

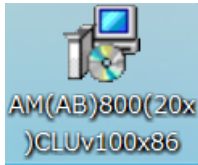
	Command Name	Format	Parameter	Remarks
	FineBlack for tap 2L-R	BLR3?<CR><LF>		User
22	BayerPixel FineBlack for tap 2L-B	BLB3 =[Param.]<CR><LF> BLB3?<CR><LF>	-512 to 511	Tap3 Black Fine For User
23	BayerPixel FineBlack for tap 2R-R	BLR4 =[Param.]<CR><LF> BLR4?<CR><LF>	-512 to 511	Tap4 Black Fine For User
24	BayerPixel FineBlack for tap 2R-B	BLB4 =[Param.]<CR><LF> BLB4?<CR><LF>	-512 to 511	Tap4 Black Fine For User
K - Blemish				
1	Blemish Reduction	BLM =[Param.]<CR><LF> BLM?<CR><LF>	0=off, 1=Black, 2=White, 3=Both	
2	ReCalibrate Blemish	BMRC =[Param.]<CR><LF>	Param : 1=Black 2=White	
3	Blemish Threshold White	BMTHW =[Param.]<CR><LF> BMTHW?<CR><LF>	0 to 16383	
4	BLMP White H	BMWH =[Param1],[Param2] <CR><LF> BMH?[Param1]<CR><LF>	Param1 : Blemish No. 1 to 256 Param2 : H position	
5	BLMP White V	BMWV =[Param1],[Param2] <CR><LF> BMV?[Param1]<CR><LF>	Param1 : Blemish No. 1 to 256 Param2 : V position	
L – ALC control				
1	Auto Iris Lens Control Signal output	AIC =[Param.]<CR><LF> AIC?<CR><LF>	0=off, 1=on	
2	Iris Reverse Gain	IRRG =[Param.]<CR><LF>	0=ON 1=OFF	
3	Iris State Control	IRSC =[Param.]<CR><LF>	0=Video 1=Close 2=Open	
4	Iris Sync Level	IRSL =[Param.]<CR><LF>	0 to 255	
5	Channel area	CHA =[Param.]<CR><LF> CHA?<CR><LF>	1=Low Right; 2=Low Center; 3=Low Left; 4=Middle Right; 5=Middle Center; 6=Middle Left; 7=High Right; 8=High Center; 9=High Left;	

	Command Name	Format	Parameter	Remarks
M – Flat field correction				
1	Flat Field Correction Control	SDM =[Param.]<CR><LF> SDM? <CR><LF>	0=Off, 1=Factory, 2=User	
2	Recalibrate FFC	RS =[Param1]<CR><LF>	0 Only	Save User Area
3	Request the Result of FFC	SDRS? <CR><LF>	0=Complete. 1=Too Bright. 2=Too dark. 3=Timeout Error. 4=Busy. 5=Limit. 6= Trig is not set as Normal.	
N - Others				
1	Temperature	TMP0? <CR><LF>	0 to 0xFFF8 (/ 128 → °C)	
2	Noise Reject SW	NR =[Param.]<CR><LF> NR? <CR><LF>	0=off, 1=on	
O – Sequence exposure control operation				
1	Exposure Sequence	EXSQ =[Param.]<CR><LF> EXSQ? <CR><LF>	0=OFF 1=ON	Available when EM=1,2
2	Exposure Sequence No N (1 ~ 16)	PES(N) =[Param.]<CR><LF> > PES(N)? <CR><LF>	0 ~ 15	
3	Exposure Repeat Time N (1 ~ 16)	PER(N) =[Param.]<CR><LF> > PER(N)? <CR><LF>	0 ~ 15	
4	Exposure Sequence Reset	EXSR =[Param.]<CR><LF> EXSR? <CR><LF>	0=OFF 1=ON	Effective when EXSQ=1. Only command 1 is used. In the firmware, 1 is immediately turned to 0.
5	Exposure Sequence End Point	EXSEP =[Param.]<CR><LF> > EXSEP? <CR><LF>	0=OFF 1=ON	Effective when EXSQ=1. Only command 1 is used. In the firmware, 1 is immediately turned to 0.
6	Exposure time 1	PE1 =[Param.]<CR><LF> PE1? <CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
7	Exposure time 2	PE2 =[Param.]<CR><LF> PE2? <CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
8	Exposure time 3	PE3 =[Param.]<CR><LF>	10μs ~ 2000000μs	Available when

AM-800CL / AB-800CL

	Command Name	Format	Parameter	Remarks
		PE3?<CR><LF>		EXSQ=1
9	Exposure time 4	PE4=[Param.]<CR><LF> PE4?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
10	Exposure time 5	PE5=[Param.]<CR><LF> PE5?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
11	Exposure time 6	PE6=[Param.]<CR><LF> PE6?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
12	Exposure time 7	PE7=[Param.]<CR><LF> PE7?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
13	Exposure time 8	PE8=[Param.]<CR><LF> PE8?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
14	Exposure time 9	PE9=[Param.]<CR><LF> PE9?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
15	Exposure time 10	PE10=[Param.]<CR><LF> PE10?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
16	Exposure time 11	PE11=[Param.]<CR><LF> PE11?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
17	Exposure time 12	PE12=[Param.]<CR><LF> PE12?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
18	Exposure time 13	PE13=[Param.]<CR><LF> PE13?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
19	Exposure time 14	PE14=[Param.]<CR><LF> PE14?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
20	Exposure time 15	PE15=[Param.]<CR><LF> PE14?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
21	Exposure time 16	PE15=[Param.]<CR><LF> PE14?<CR><LF>	10μs ~ 2000000μs	Available when EXSQ=1
P - Saving and loading data in EEPROM				
1	Load Settings (from Camera EEPROM)	LD=[Param.]<CR><LF>	0=Factory area 1=User 1 area 2=User 2 area 3=User 3 area	Latest used DATA AREA becomes default at next power up.
2	Save Settings (to Camera EEPROM)	SA=[Param.]<CR><LF>	1=User 1 area 2=User 2 area 3=User 3 area Note : parameter 0 is not allowed	
3	EEPROM Current Area No Request.	EA?<CR><LF>	0=Factory area 1=User 1 area 2=User 2 area 3=User 3 area	The camera return the latest used DATA AREA.

10. Camera control tool



The AM-800CL and AB-800CL camera Control Tool can be downloaded from JAI Web site www.jai.com. This control software is available for Windows2000/XP/Vista/7. In this control tool, the developers guide is included in order for customers to create their own programs.

10.1. Control tool windows

Here is some practical information about the Camera Control Tool:

1. The Camera Control Tool bar is always on top of other windows.
2. When you minimize the Camera Control Tool bar all open windows will close.
3. It is possible to work with the Camera Control Tool when the camera is online and when the camera is offline.
4. The newer JAI cameras always start up with the last used user area (but for some old models it will start up with the last saved user area.)
5. The Camera Control Tool saves the last used settings (not the user area), which don't have to be the same as for the last saved user area.
6. The setup file 'CameraName.ini' stores all information about camera settings. When the program is started the last settings for the program are loaded from the file 'CameraName.ini'

10.2. Camera Control Tool interface



refreshed after reboot.

The Camera control tool includes an About Window, Communication Window and Camera Control Window.

The Camera Control software consists of the main tool bar and associated tool windows. When each icon in the main tool bar is clicked, the associated window will open. The program is

10.2.1 About Window

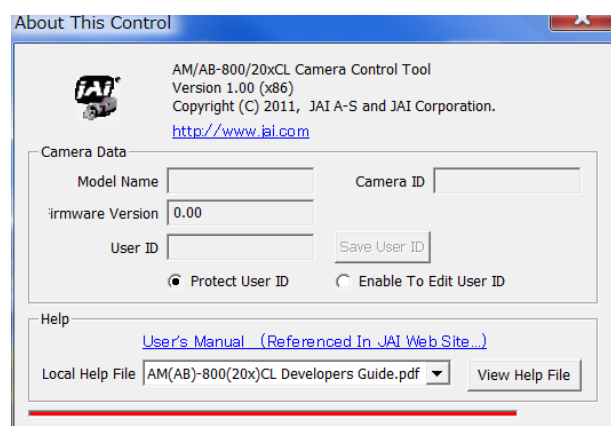
The About Window contains a picture of the camera and information about the version of the program, Internet connection to JAI A/S and access to the help documents.

The List box that contains the help documents will list all files, which have the extension .pdf and that are found in the program (default) folder

It is possible to download updated operation manuals from the jai website:

<http://www.jai.com>

The About Window also shows Model Name, Camera ID and User ID. It is possible to edit and save free text in User ID.



At the bottom of the windows (all windows but the Communication Window is a colored bar. The bar is red when the Camera Control Tool is not connected to a camera or when the camera is turned off. The bar is green when the Camera Control

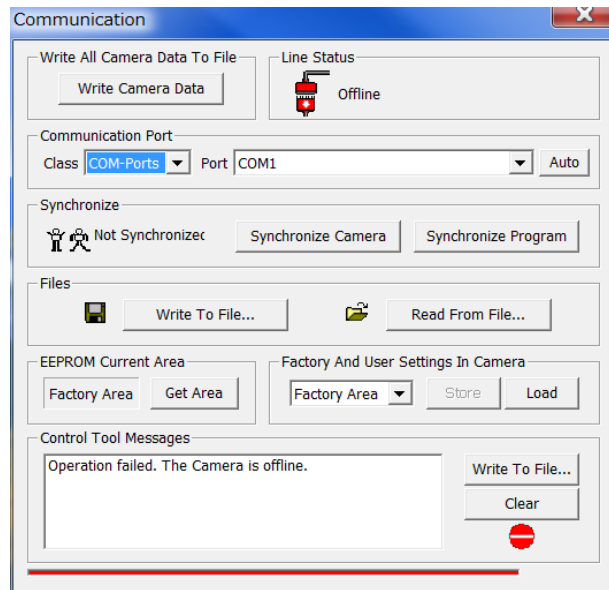
Tool is connected to a camera and the camera is turned on.

10.2.2 Communication Window

The Communication Window is used to connect the Camera Control Tool with the JAI camera. Depending on the camera there are 2 possible ways to communicate with a JAI camera.

RS-232C

Select the communication port, where the serial cable is connected from the list box in the 'Communication Port' field, or click the 'Auto' button to search for a camera on communication port 1 to 16. The camera control program automatically sends a camera request on every communication port. The user is prompted to use a communication port if a camera answers the request.

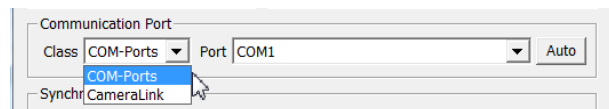


RS-232C and Camera Link

The Communication Window looks a bit different when it is possible to communicate with the camera using Camera Link and RS-232 com port. The Communication area contains 2 list boxes now.

RS-232CCommunication

1. Select 'COM-ports' from the 'CL Manufacturer/COM-ports' list Box.
2. Select the communication port, where the serial cable is connected to the camera from the 'Serial Port' list box or click the 'Auto' button to search for a camera on communication port 1 to 16.

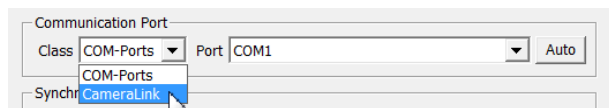


The Serial Port list box and the Auto search button are only active when COM-ports is selected.

Camera Link communication

The 'CL Manufacturer/COM-ports' list box also contains DLL file names (or frame grabber names) for all Camera Link frame grabbers that are installed in the pc. This is done by using a DLL file called "clserial.dll" to upload all frame grabber DLLs that are found in the pc.

Just select the option for the frame grabber that is installed in the pc.



Auto Search

Click the auto button to search for a camera on communication port 1 to 16. The camera control program automatically sends a camera request on every communication port. The user is prompted to use a communication port if a camera answers the request.

This button is only used for RS-232 communication.

Off/On-line Mode

The Camera Control Tool Application can run offline (without a camera attached) and all functions are fully functional in offline mode.

Offline mode is indicated in the Communication Window, where a status field with graphic and text indicates the on/offline status.

Changing the selected communication port (from the Communication Window) changes the online/offline status. If a camera is found on the selected communication port the application runs online otherwise offline.



Changing the settings in the application will automatically update the camera settings when the application is online.

If the application loses connection with the camera it will automatically go to offline mode and it is indicated in the Communication Window.

Synchronize program and camera

The Camera Control software has the ability to synchronize either the camera or the program. Click Synchronize camera to write all settings from the program to the camera or click the Synchronize program to load all settings from the camera to the program.



Files

When clicking the Write to File or Read from File button, the user is prompted for a file using a standard file dialog. New files are created if they do not already exist.

Files for camera settings have the ".cam" extension. Information about the communication port is not stored in the files. All settings are automatically sent to the camera when a file has been loaded (if the camera is online).

Factory and User Settings

Use the Store button to store the current camera settings into the user settings area in EEPROM. Current camera settings are not saved when the camera is turned off. To save current camera settings you have to save them to the available user areas.

Use the Load button to restore previously saved camera settings from either the Factory or the User EEPROM area.

Write All Camera Data to File.

Click the "Write Camera Data" button to save all camera settings into a text file. The information that can be saved is:

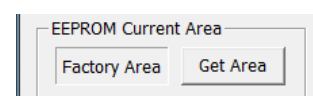
Model Name, Camera ID, User ID, Firmware Version, Current Settings, Factory Settings and the available User Areas.

The file is formatted as shown in the picture below:



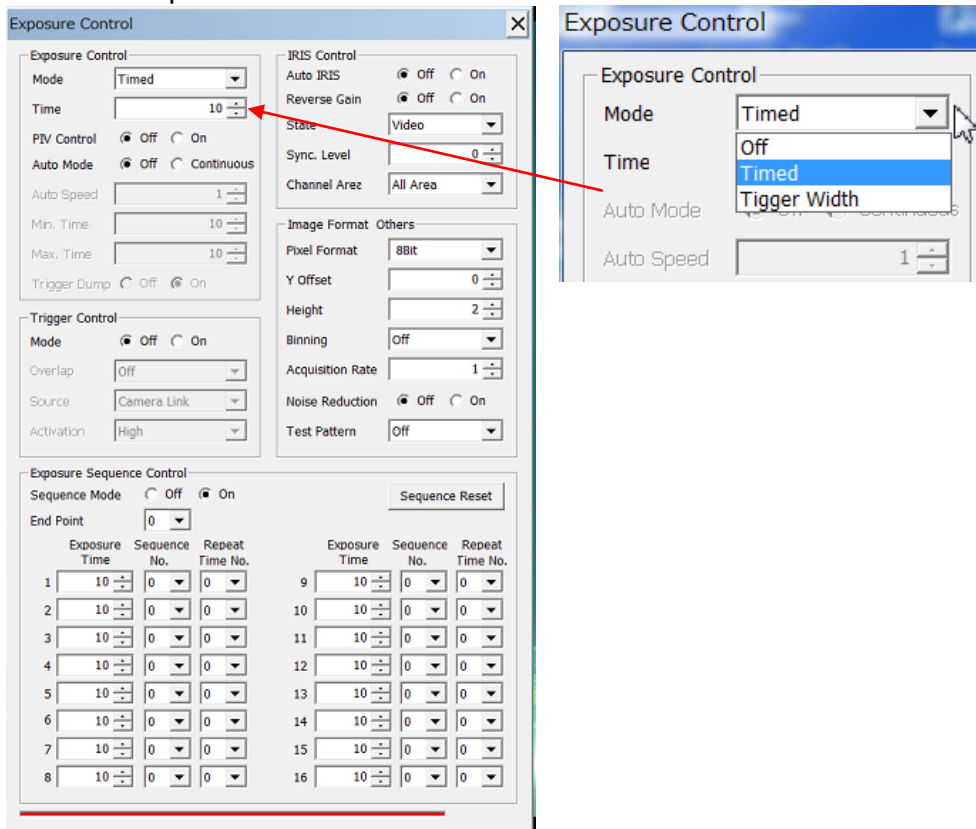
EEPROM Current Area.

Click the 'Get Area' button to read the power up settings area number.

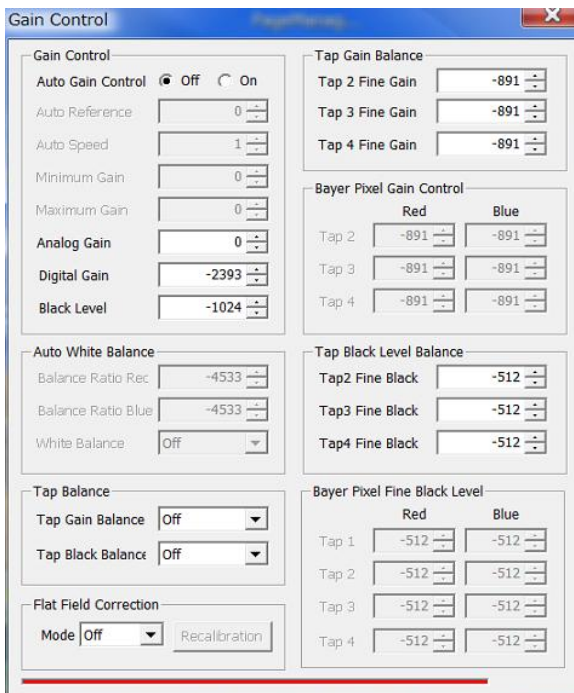


10.2.3 Camera Control Window

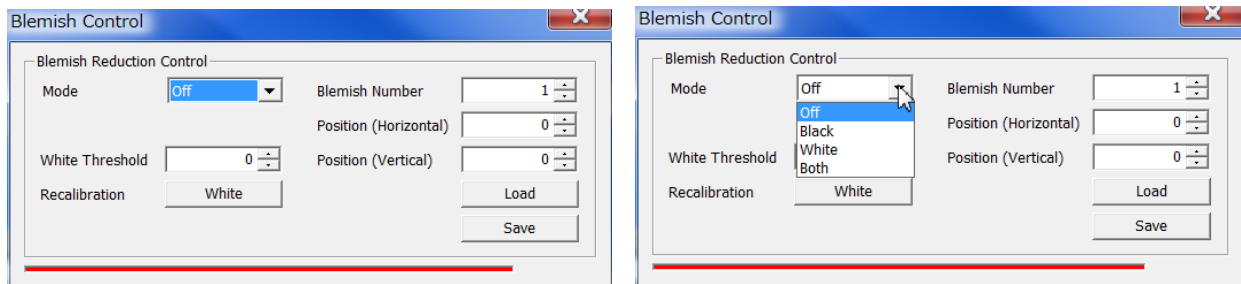
10.2.3.1 Exposure Control



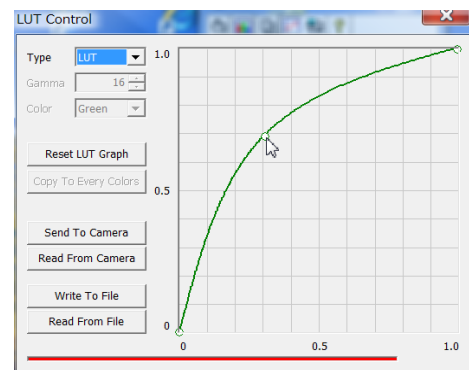
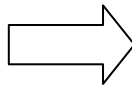
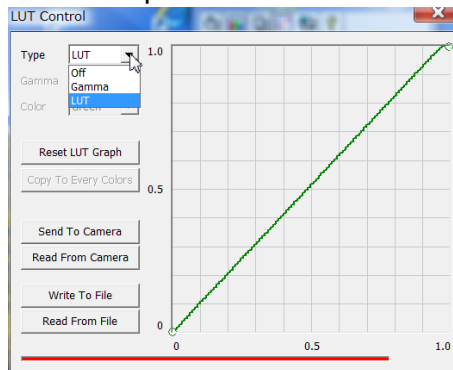
10.2.3.2 Gain Control



10.2.3.3 Blemish Control



When “Open LUT table” is clicked, the left side window will open, for example for blue channel.



11. External appearance and dimensions

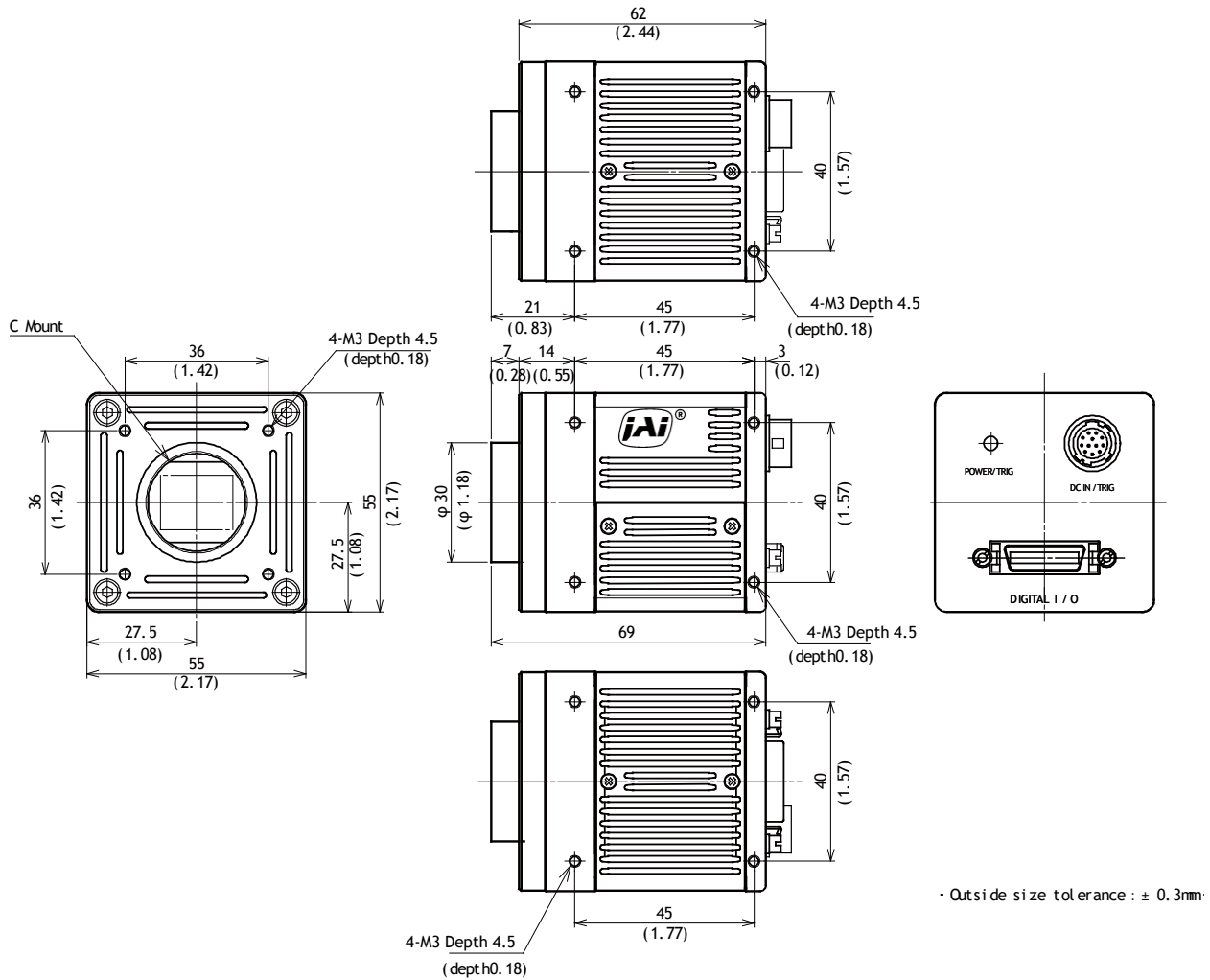


Fig. 46 Outside dimensions (C mount)

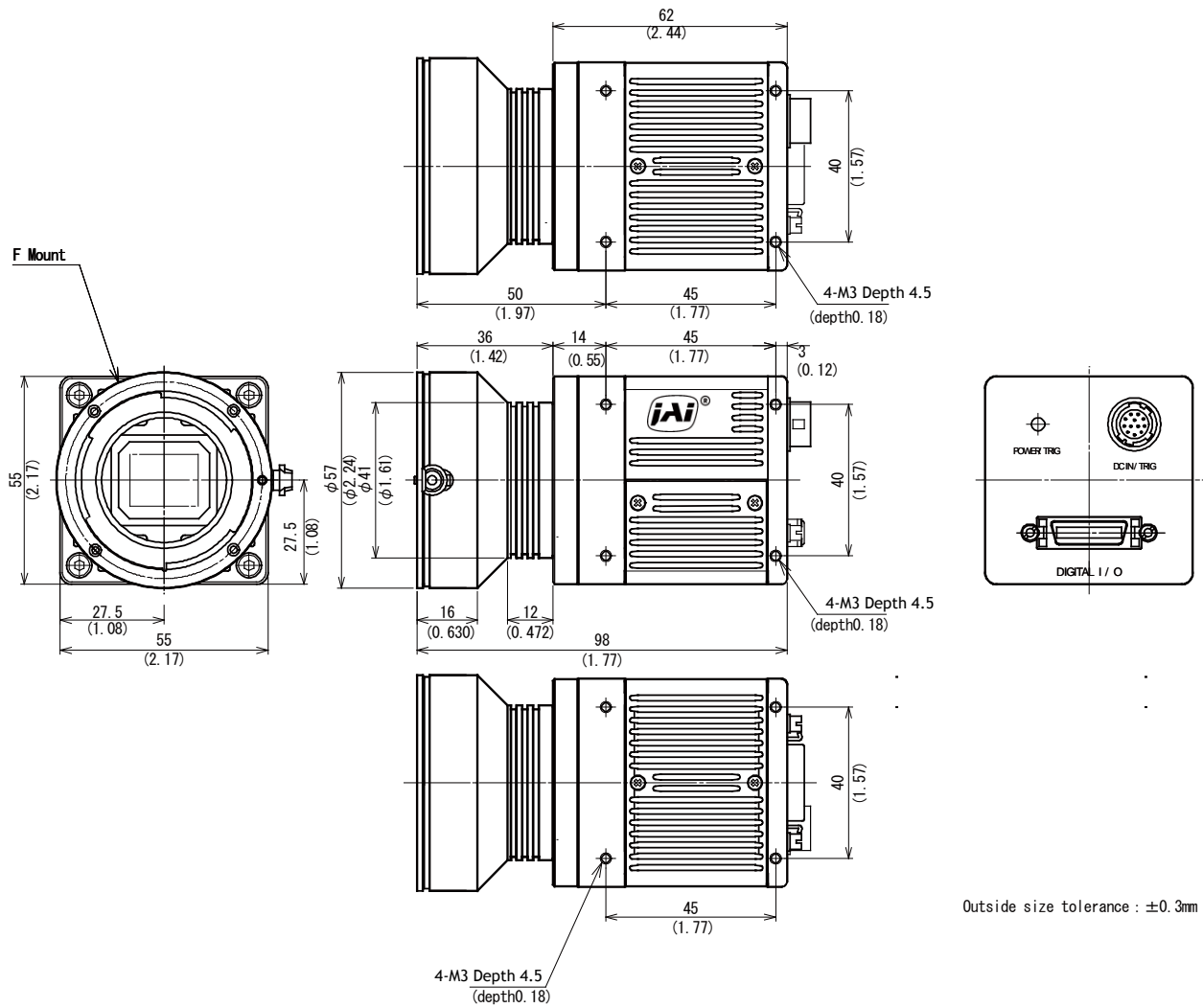


Fig.47 Outside dimensions (F mount)

12. Specifications

12.1 Spectral response

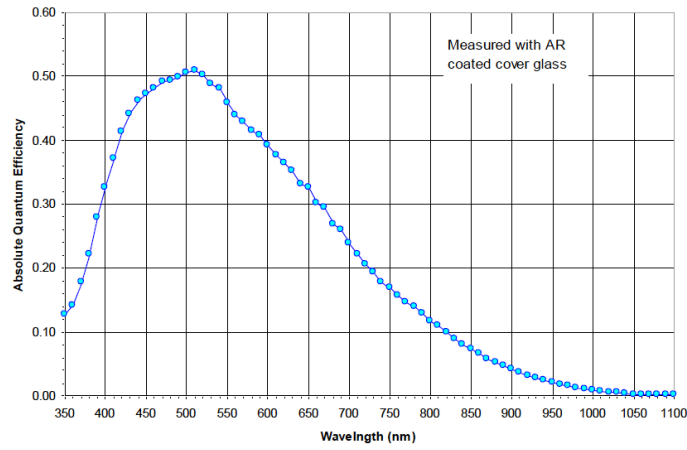


Fig. 41 Spectral response (AM-800CL)

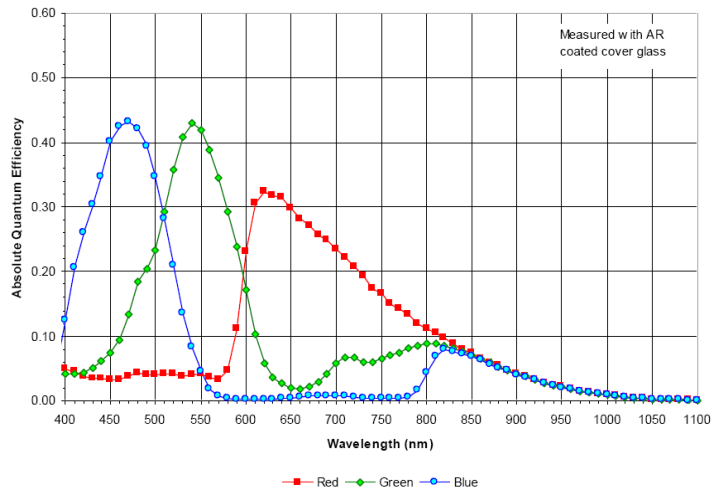


Fig.42 Spectral response (AB-800CL)

12.2 Specifications table

Specifications		AM-800CL	AB-800CL
Scanning system		Progressive scan, 4 taps	
Synchronizing system		Internal	
Image sensor		4/3 inch Monochrome interline CCD	4/3 inch Bayer color interline CCD
Sensing area		18.13 (h) x 13.60 (v) mm 22.66 mm diagonal	
Cell size		5.5 (h) x 5.5 (v) μ m	
Active pixels (for output)		3296 (h) x 2472 (v)	3296 (h) x 2472 (v) (TBD)
Pixel clock(sensor)		40 MHz	
Horizontal (Camera Link)		21.50537 KHz (1H=46.5 μ s) (3720 clocks per line) (Pixel clock 80MHz)	
Vertical		Total lines 2520 (Effective 2472)	
Frame rate (Full Resolution)		Continuous mode 17.0263 fps (58.7ms)	Continuous mode Bayer output 17.0263fps (58.7ms) RGB output 8.5fps (117ms)
Image Format	Full resolution	3296(h) x 2472(v)	Bayer 3296(h) x 2472(v) RGB 3296(h) x 2472(v)
	Binning (h x v)	1 x 2 3296(h) x 1236(v) 2 x 1 1648(h) x 2472(v) 2 x 2 1648(h) x 1236(v)	-
	AOI	Height 1 line / step Offset Y 1 line / step	Height 2 line / step Offset Y 2 line / step
		Note: number of horizontal pixels cannot be changed.	
Sensitivity on sensor (minimum)		0.01 Lux (Max. gain, Shutter OFF, 50% video)	0.2 Lux (Max. gain, Shutter OFF,50% Green, w/IR cut filter)
S/N ratio		More than 57 dB (0dB gain, CCD output=300mV)	
Digital Video output Camera Link	Pixel format	2 tap	
	Pixel clock	80 MHz	
	Pixel bit depth	8-bit, 10-bit, 12-bit	BAYER 8-bit, 10-bit, 12-bit RGB 8-bit
Iris video output		Analog, 0.7 V p-p with 0.3V H.sync	
Sync output		Camera Link : FVAL, LVAL, DVAL, EEN Hirose 12-pin: XEEN, 4V p-p (No termination)	
Acquisition frame rate		Frame rate can be varied from 17.026Hz to 0.5Hz	
Exposure Control (Trigger)	OFF		
	Timed	10 μ s to 58.73ms(Shutter OFF), 1 μ s step	
	Trigger width	10 μ s to 2 sec.	
	PIV		
	Trigger- dump		
Trigger Control	Source	Line 0=Camera Link CC1 or Line1=Hirose 12P 10pin	
	Activation	Rising edge or falling edge Level High or Level Low	
Gain		Manual/Auto : -3dB to +24 dB (1 Step 0.01 dB) Fine gain (Digital gain) (1step=0.00012 times)	Manual/Auto : 0dB to +24 dB (1 Step 0.01 dB) Fine gain (Digital gain) (1step=0.00012 times)
White balance		-	OFF: Manual ON: One push white balance Range: 3200K to 9000K

AM-800CL / AB-800CL

Black level	32 LSB at 10-bit output, -256 LSB to 255 LSB can be changed, 1 step is 0.25dB (at 10-bit output)	
LUT	OFF: $\gamma=1.0$, ON= 256 points can be set	
Gamma	0.45 to 1.0 can be set, Adjusting step is 0.05	
Flat Field Compensation	Compensated by 128 x 128 pixels block	
Blemish Compensation (Bright)	Built in, maximum 64 pixels for dark and bright compensation per 1 tap (note: black compensation is only by factory preset)	
Color interpolation	-	3 x 3 interpolation matrix
Test pattern	OFF/Black-white/Gray H-ramp/ Gray V-ramp/white(100%)	OFF/Color bar/Gray H-ramp / Gray V-ramp /White(100%)
Temperature sensor	-55 to +125°C (measuring range), resolution is 0.0625°C	
Serial communication	Camera Link or Hirose 12-pin	
Power	DC+12V to +24V \pm 10%, 7.8W (at normal operation, DC+12V)	
Lens mount	C mount or F mount The rear protrusion on C mount lens must be less than 10mm. The rear protrusion on F mount lens must be less than 12mm	
Flange back	C mount : 17.526 mm, tolerance 0 to -0.05 mm F mount : 46.5 mm, tolerance 0 to -0.05 mm	
Sensor alignment	X and Y axis: \pm 0.1 mm (at center)	
Optical filter	- Protection glass only	Optical low pass filter
Operating temperature	-5°C to +50°C	
Humidity	20 - 80% non-condensing	
Storage temp/humidity	-25°C to +60°C/20% to 80 % non-condensing	
Vibration	10G (20Hz to 200Hz, XYZ)	
Shock	70G	
Regulatory	CE (EN61000-6-2 and EN61000-6-3), FCC part 15 class B, RoHS, WEEE	
Size	C-mount	55 x 55 x 69 mm (W x H x D)
	F-mount	55 x 55 x 98 mm (W x H x D)
Weight	C-mount	280g
	F-mount	340g,

Note1): Approximately 5 minutes pre-heating is required to get the mentioned specifications.

Note2): The above specifications are subject to change without notice.

Appendix

1. Precautions

Personnel not trained in dealing with similar electronic devices should not service this camera. The camera contains components sensitive to electrostatic discharge. The handling of these devices should follow the requirements of electrostatic sensitive components.

Do not attempt to disassemble this camera.

Do not expose this camera to rain or moisture.

Do not face this camera towards the sun, extreme bright light or light reflecting objects.

When this camera is not in use, put the supplied lens cap on the lens mount.

Handle this camera with the maximum care.

Operate this camera only from the type of power source indicated on the camera.

Power off the camera during any modification such as changes of jumper and switch setting.

2. Typical Sensor Characteristics

The following effects may be observed on the video monitor screen. They do not indicate any fault of the camera, but do associate with typical sensor characteristics.

V. Aliasing

When the CCD camera captures stripes, straight lines or similar sharp patterns, jagged edges may appear on the monitor.

Blemishes

All cameras are shipped without visible image sensor blemishes.

Over time some pixel defects can occur. This does not have a practical effect on the operation of the camera. These will show up as white spots (blemishes).

Exposure to cosmic rays can cause blemishes to appear on the image sensor. Please take care to avoid exposure to cosmic rays during transportation and storage. It is recommended using sea shipment instead of air flight in order to limit the influence of cosmic rays on the camera. Pixel defects/blemishes also may emerge due to prolonged operation at elevated ambient temperature, due to high gain setting, or during long time exposure. It is therefore recommended to operate the camera within its specifications.

Patterned Noise

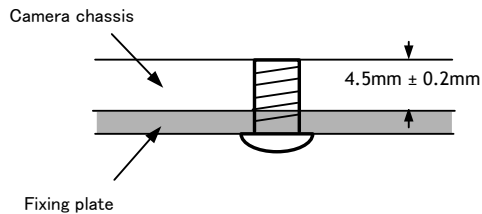
When the sensor captures a dark object at high temperature or is used for long time integration, fixed pattern noise may appear on the video monitor screen.

3. Caution when mounting a lens on the camera

When mounting a lens on the camera dust particles in the air may settle on the surface of the lens or the image sensor of the camera. It is therefore important to keep the protective caps on the lens and on the camera until the lens is mounted. Point the lens mount of the camera downward to prevent dust particles from landing on the optical surfaces of the camera. This work should be done in a dust free environment. Do not touch any of the optical surfaces of the camera or the lens.

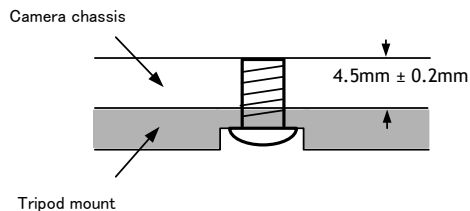
4. Caution when mounting the camera

When you mount the camera on your system, please make sure to use screws of the recommended length described in the following drawing. Longer screws may cause serious damage to the PCB inside the camera.



Mounting the camera to fixing plate

If you mount the tripod mounting plate, please use the provided screws.



Attaching the tripod mount

5. Exportation

When exporting this product, please follow the export regulation of your own country.

6. References

1. This manual can and datasheet for AM-800CL / AB-800CL can be downloaded from www.jai.com
2. Camera control software can be downloaded from www.jai.com

- 65 -

User's Record

Camera type: AM-800CL / AB-800CL

Revision:

Serial No.

Firmware version.

For camera revision history, please contact your local JAI distributor.

User's Mode Settings.

User's Modifications.

Company and product names mentioned in this manual are trademarks or registered trademarks of their respective owners. JAI A-S cannot be held responsible for any technical or typographical errors and reserves the right to make changes to products and documentation without prior notification.

Europe, Middle East & Africa

Phone +45 4457 8888

Fax +45 4491 3252

Asia Pacific

Phone +81 45 440 0154

Fax +81 45 440 0166

Americas

Phone (toll-free) +1 800 445 5444

Phone +1 408 383 0300

Visit our web site at www.jai.com



See the possibilities